USER'S MANUAL

SPECTRUM III HYBRID READER MAGSTRIPE & SMART CARD

Standard & Compact chassis

CE

EMV™

80064501-001-J
February 18, 2010

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This equipment has not been tested to comply with Part 15 of the FCC Rules for a digital device. This device is designed to be incorporated into a product that will be tested to comply with all regulatory requirements.

CERTIFICATIONS

The spectrum III reader has passed EMV 2000 Terminal Level 1 testing on May 4, 2005. The RS232 PC/SC driver was certified and signed by WHQL December 2003. The USB PC/SC driver was certified and signed by WHQL May 9, 2005 and USB CDC is scheduled to be certified and signed by WHQL. These drivers were certified with Windows 2000® and Windows XP® (only the 32 bit versions). CE certification is in process.

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Table of Contents

1. OVERVIEW AND INTRODUCTION 7
1.1. General 8
1.2. Features 8
1.3. Factory Installed Options 9
1.4. Optional Accessories 9
1.5. Spectrum I, Spectrum IIa, Spectrum II and Spectrum III Differences 9
2. DEFINITIONS, DOCUMENTS AND LINKS 10
2.1. Definitions 10
Related Documents 12
2.2. Applicable Links 12
3. QUICK START 13
3.1. Quick Start Versions 13
3.2. Required Equipment 13
3.3. Installing Drivers 14
3.3.1. Install PC/SC Driver 14
3.3.2. Install FTDI Driver 15
3.3.3. Install CDC Driver 16
3.4. Demonstration Programs 17
3.4.1. PC/SC Demonstration 17
3.4.2. Non-PC/SC Demonstration 18
3.5. FAQ (Frequently Asked Questions) 18
4. PC/SC GENERAL DESCRIPTION 20
4.1. Purpose of PC/SC 20
4.2. EMV verses PC/SC 20
4.3. IdtLib.dll 21
4.4. How the Various Parts of the PC/SC Fit Together. 21
5. HYBRID READER—GENERAL AND ICC 22
5.1. Operation 22
5.1.1. Smart Card Features 22
5.1.2. Magnetic Card Read Modes 22
5.1.3. Latch Operation 22
5.1.4. Smart Card Access 23
5.1.5. LED Handling 23
5.1.6. Lighted bezel option (4 LEDs) 24
5.1.7. Card Status Notification [B0 xx] or [2F 00] 25
5.2. Communication Structure 26
5.2.1. Host Command 26
5.2.2. Reader Response 26
5.2.3. Example of LRC Calculation 27
5.2.4. Communication Timing 27
5.3. General Reader Commands Description 28
5.3.1. Get Firmware Version Description [39] 28
5.3.2. Get Reader Status [24] 28
5.3.3. Latch Close Command [4C 01] 29
5.3.4. Latch Open Command [4C 00] 29
5.3.5. Host LED Control Command [6C] 30

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5.3.6. Reader Reset Command [49] 30
5.3.7. Get Copyright Information [38] NEW 30
5.3.8. Enter Downloader (Upgrade Firmware) [7A] NEW 31
5.4. Reader Configuration Commands Description 31
5.4.1. Restore Configuration Settings to Default [53 18] 31
5.4.2. Read All Configuration Settings [52 1F] 32
5.4.3. Read Specific Configuration Setting [52 nn] 33
5.4.4. Set BAUD Rate [53 41] (RS232 only) 34
5.4.5. Set Card Option [53 10] 35
5.4.6. Set Operation Mode [53 11] 36
5.4.7. Set Compatibility Mode [53 1E] NEW 38
5.4.8. Read Reader Serial Number [52 4E] 38
5.5. Microprocessor Commands Descriptions 38
5.5.1. Smart Card Commands Summary 39
5.5.2. Transmission Protocol for ICC Cards 39
5.5.3. Power On (Get ATR) Command [6E] 40
Power Off Command [4D] 42
5.5.4. ICC Reader Microprocessor Card Output Command Structure [41] 42
5.5.5. ICC Reader Microprocessor Card Input Command Structure [61] 43
5.5.6. ICC Reader Microprocessor Card Raw T=1 Command Structure [46] 44
5.5.7. ISO 7816 Command Structure 46
5.6. Memory Card Commands 47
5.6.1. General 47
5.6.2. ICC Reader Memory Card Command Structure [42] 47
5.6.3. Set Memory Card Type [53 12] 47
5.6.4. Set Memory Card Page Write Size [53 15] 47
5.7. SAM—Secure Access Module Support 48
5.7.1. SAM Purpose 48
5.7.2. Typical SAM Operation 48
5.7.3. ICC Connector Selection [43 0n] 49
5.7.4. Set SAM Card Option [53 6n 02] 50
5.7.5. SAM Card Operation Scenario 50
5.7.6. Notes for SAM Card Operation 51
5.8. Return Status Summary and Explanation 51
6. HYBRID READER—MAGNETIC STRIPE SUPPORT 52
6.1. Features 52
6.1.1. Message Format 52
6.1.2. Magnetic Stripe Data 52
6.2. Features Description 52
6.3. Default Card Data Output 53
6.4. Buffered Mode Operation Commands 54
6.4.1. Arm to Read Command [50 01 30] 54
6.4.2. MSR Reset Command [50 01 32] 54
6.4.3. Read MSR Data Command [51 01] 55
6.5. MSR Configuration Commands Description 55
6.5.1. MSR Transmit Mode Setting [53 1A] 56
6.5.2. MSR Read Direction Setting [53 1D] 56

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6.5.3. MSR Send Option Setting [53 19] 56
6.5.4. MSR Data Terminator Setting [53 21] 56
6.5.5. MSR Data Prefix String Setting [53 D2] 57
6.5.6. MSR Data Suffix String Setting [53 D3] 57
6.5.7. Track ID Setting [53 3n] 57
6.5.8. Track Selection Setting [53 13] 58
6.5.9. Track Separator Setting [53 17] 58
7. PC/SC APPLICATION PROGRAMMING IN C++ 59
7.1. PC/SC Programming Overview 59
7.2. SCardEstablishContext 59
7.3. SCardConnect 59
7.4. SCardTransmit 59
7.5. SCardDisconnect 60
7.6. SCardReleaseContext 60
8. HYBRID READER DEMONSTRATION SOFTWARE 65
8.1. HRDLL Demo Program Non-PC/SC 65
8.2. PC/SC Visual C++ Demonstration Program 65
8.2.1. Requirement 66
8.2.2. Installation 66
8.2.3. Operation 66
8.2.4. Program Source Code: 68
8.3. PC/SC Visual Basic Demonstration Program 68
8.3.1. Requirement 68
8.3.2. Installation 69
8.3.3. Launching 69
8.3.4. Operation 69
8.3.5. Program Source Code 70
9. SPECIFICATIONS 71
10. HARDWARE DIMENSIONS, MOUNTING AND CONNECTORS 73
10.1. Dimensions of Spectrum III 73
10.2. Dimension of Spectrum III with SAM daughter board 74
10.3. Dimension of Spectrum III Compact chassis with its bezel 75
10.4. Mounting 76
10.5. Hybrid Reader Connectors 76
10.6. Hybrid Reader Bezel information 77
11. APPENDIX A: SPECIAL INSTALLATION INSTRUCTIONS 84
11.1. Installing Unsigned Driver Over Signed Drivers 84
11.2. Configuring to Allow Installation of Unsigned Drivers 84
11.3. Configuring to Display System Files 84
11.4. Configuring the Smart Card Service 85
11.5. Reconnecting a Disconnected Reader 85
11.6. Configuring PC to Support Serial Plug and Play 85
12. APPENDIX B: ID TECH PC/SC IDTLIB.DLL GUIDE 86
13. APPENDIX C: DOWNLOADING 95
14. APPENDIX C: Complete List of Response Codes 96
15. INDEX 100
16. LIMITATIONS 102

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Table of Figures and Tables

Figure 1 – Orientation for Inserting Card into Reader 17
Figure 2 – Simplified PC/SC Component Organization 21
Figure 3 – Spectrum III Dimensions 73
Figure 4 – Spectrum III Dimensions With SAM Daughter Board 74

Table 1 – Reader Command ID Summary 28
Table 2 – Default MSR Configuration Settings 31
Table 3 – Configuration Function ID Summary and Explanation 33
Table 4 – Reader Command IDs Affecting Smart Card Summary 39
Table 5 – Response Status Code Summary and Explanation 51
Table 6 – Magnetic Stripe Message Formatting 52
Table 7 – SCARD Error to Value 60
Table 8 – SCARD Error Text Description 62
Table 9 – Electrical Specifications 71
Table 10 – Environmental Specifications 71
Table 11 – Reliability Specifications 71
Table 12 – Mechanical Specifications 72
Table 13 – SCARD Routine Return Values 92

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1. OVERVIEW AND INTRODUCTION

ID TECH's Intelligent Hybrid Insert Reader supports both magnetic stripe card reading, and smart cards or IC cards. The reader communications are RS232 or USB. The reader communicates with the host using a generic protocol. The USB and PC/SC reader versions communicate with a driver running on a Windows PC.

There are two chassis types used for the Spectrum III Hybrid Insert Readers. The standard chassis is generally form & fit equivalent to industry standards used typically in POS & ATM applications and a full variety of options. The compact chassis is smaller and is fitted with a single smaller sized bezel and is used typically in applications where a smaller profile is wanted. The compact chassis does not provide the card latch, front switch, and debris gate options. The same PCA design and features are used on both chassis types.

This manual is a design guide for installing and interfacing the Spectrum III (abbreviated SPT3) reader. To a PC the SPT3 can appear as either a COM device or a PC/SC reader. If one is programming a PC/SC reader, for the most part, it will be unnecessary to know the details of the communication between the PC and the reader. This document briefly describes the standard PC/SC v1.0 interface. If one has already programmed a PC/SC reader into your application and you now wish to change readers perhaps to add triple track magnetic stripe reading or memory cards then one should study the interface to the ID TECH provided idtlib.dll. This should allow easy integration of these features into your application.

If one has programmed for an earlier RS232 version of a Spectrum reader the SPT3 should be able to replace that reader. The SPT3 also supports a USB interface that is compatible with an application written for an RS232 Spectrum reader.

The following sections define the required protocols for communicating with, and performing operations to an IC card. All T=0 and T=1 microprocessor cards are supported. Check with your ID TECH representative for information on the types of memory IC cards supported.

PC/SC is a standard interface between a smart card reader and a PC. The PC/SC driver converts the PC/SC commands to the commands used natively by the reader. This makes it convenient for the programmer to develop an application without being committed to a particular reader. The PC/SC interface only defines T=0 and T=1 microprocessor interface cards. For functions that access the other features of the reader beyond these cards such as magnetic stripe reading, latching, memory cards and SAM support, the PC/SC interface supports these functions with vendor specific calls. A DLL is available to aid the programmer in interfacing to these functions. This document describes the PC/SC programming and sample programs that show how to access these features. These sample programs are available on request.

The PC/SC driver only supports Windows 2000, Windows XP (32 bit only), and XP embedded.

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SPECTRUM III HYBRID MAGSTRIPE/SMART CARD READER

1.1. General

The Spectrum III reader is an intelligent manually operated insert reader for Smart Cards (ICC) and up to three tracks of magnetic stripe data. This unit can interface with asynchronous (microprocessor) types of integrated circuit cards, which conform to ISO 7816-3. It can also interface with a variety of synchronous (memory) ICC types. Units feature a large debris opening, which allows foreign matter such as coin or paper, to fall or be forced out of the card slot.

1.2. Features

- ISO 7816 and EMV 2000 compliant. Supports microprocessor cards requiring a variety of f/d ratios (speeds). Supports ICC speeds from 9600 bps to 76.8k bps.
- PC/SC Certified on Windows 2000 and Windows XP operating systems.
- Reads and writes microprocessor cards using both T=0 and T=1 protocols.
- RS232 or USB 2.0 full speed compatible.
- Uses turbo TLP-224 communication protocol to talk with the host.
- Allows the host to interrogate the device about current status and configuration information and can notify the host automatically when a status change occurs.
- 3 and 5-Volt ICCs support (including SAM support).
- Supports memory card types: 3-byte I^2C, 4-byte I^2C, SLE4404 SLE4406, SLE4418, SLE4428, SLE4432, SLE4442, AT88SC101, et al.[1]
- Large debris slot
- Supports LED control; control either by the reader or by host commands
- Supports buffered and un-buffered modes and formatted or raw data magnetic read.
- Supports in field firmware upgrade.

[1] Contact ID TECH sales for a complete list of memory cards supported.

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1.3. Factory Installed Options

- A dual color, single bulb LED is available.
- Various bezel options available on the standard chassis.
- A compact chassis option is available for a smaller profile
- Conformal coating (on active electrical components).
- Latching mechanism to secure a card in the reader.
- SAM (Secure Application Module),
- If more than one SAM is required, a 5 SAM daughter board connectors
- Gate—this prevents foreign objects from easily entering the reader.
- 12V supply support with separate supply board (only one SAM supported).

1.4. Optional Accessories

- DB9 serial cable assembly with female plug for AC/DC adapter.
- USB adaptor cables of various standard lengths.
- AC/DC power adapter complying with your specified power requirements.
- PC/SC sample demonstration programs in Visual C++ and Visual Basic.
- Smart card demonstration software for exhibiting the capabilities of the Spectrum 3 reader in non-PC/SC mode.
- A configuration program to configure the reader's optional capabilities.
- A sample initialized T=0 microprocessor smart card. P/N 8005206-001
- A sample initialized 2K byte memory smart card. P/N 8005205-001

1.5. Spectrum I, Spectrum IIa, Spectrum II and Spectrum III Differences

- Successor to the Spectrum I, Spectrum IIa, and Spectrum II series hybrid readers. This reader supports nearly all features of the earlier readers and is backwards compatible with the Spectrum II reader.
- Field updating the reader code allows updating smart card support in this rapidly changing industry.
- A Spectrum III Reader supports RS232 or USB 2.0 full speed.
- Restored support for certain memory card types removed in some intermediate versions due to hardware limitations.
- Enhances Secure Application Module (SAM) support
- Host controlled and flashing LED support
- Code space available for additional features as the need arises.

ID TECH is committed to working with users to meet your special requirements.

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2. DEFINITIONS, DOCUMENTS AND LINKS

2.1. Definitions

AAMVA	American Association of Motor Vehicle Administrators
ASCII	American Standard Characters for Information Exchange
ATR	Answer To Reset—the power on response from a ICC
Asynchronous card	a microprocessor ICC, that follows ISO7816-3
BPI	Bits Per Inch
BAUD	Roughly the RS232 communication in bits per second
CDC	Communication Device Class, this allows a USB reader to appear as a COM device to a PC application.
Coercivity	The resistance of a magnetic field to change measured in Oersteds.
C-APDU	Command-Application Protocol Data Unit
CDL	California Drivers License format
EMV	Europay-MasterCard-Visa—Financial transaction certification
F/D Ratio	F=Frequency, D=Divisor. In ISO 7816-3, these terms specify the speed of the ICC interface.
FTDI	Hardware support for allowing a RS232 device to communicate USB to PC but appears to an application as a RS232 device.
Gate	A device preventing easy entry of anything except a card into the reader. This can limit dust and debris from getting inside.
Host	The Personal Computer to which the reader is attached.
IFD	Interface Device—this is how ISO 7816 refers to the reader.
IFS	Information Field Sizes, see ISO7816-3 section 9.5.2
IC, ICC	Integrated Circuit Card
IPS	Inches Per Second
ISO	International Standards Organization
Hex	Hexadecimal, base 16
Hybrid	Combination of two technologies here Smart Card and MSR
LED	Light Emitting Diode
LRC	Longitudinal Redundancy Check a form of error check character
Microprocessor card	Either T=0 or T=1 asynchronous card
Memory card	An ICC, commands supported vary by manufacturer, generally simpler and less expensive than microprocessor cards.
MSDN	Microsoft Developers Network
MSR	Magnetic Stripe Reader
OLE	Object Linking and Embedding
OPOS	OLE for Point Of Sale, driver decodes magnetic stripe data into logical fields
PnP or PNP	Plug-and-Play
PC	Personal Computer
PCA	An assembled Circuit Board
PC/SC or PCSC	Personal Computer/Smart Card interface, an industry standard

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PPS	Protocol and Parameters Selection, see ISO7816-3 section 7.2
PSC	Programmable Security Code
R-APDU	Response-Application Protocol Data Unit
RS232	Reference Standard serial communication
SAM	Secure Access Module also called Secure Application Module.
Smart Card	ICC, includes both memory and microprocessor cards
Sp2	Abbreviation for Spectrum II
SPT3	Abbreviation for Spectrum III
SPT3c	SPT3 firmware supporting USB CDC
SPT3s	SPT3 firmware supporting RS232
SPT3u	SPT3 firmware supporting USB PC/SC
Synchronous card	see Memory card
USB	Universal Serial Bus—a high speed connection to the host that also provides the reader with power
Transport code	A password used between the ICC manufacturer and the card customer.
WHQL	Windows Hardware Quality Control Labs

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Related Documents

Published Documents

EMV 2000 *Integrated Circuit Card Specifications for Payment Systems* 4.0 (2000)
ISO 7810 *Identification cards – Physical characteristics* (1995)
ISO 7811 *Identification cards –Recording technique* (1995)
ISO/IEC 7816 *Identification Cards - Integrated circuit(s) cards with contacts*
Part 2: *Dimension and location of the contacts* (1989, DIS 1998)
Part 3: *Electronic signals and transmission protocols* (1997)
Part 4: *Inter-industry commands for interchange* (1995/Amd.1:1997)
Amd1: Impact of secure messaging on the structures of APDU messages.
ISO 10202-4 *Financial transaction cards—Security architecture of financial transactions systems using integrated circuit cards—Part 4: Secure application modules*
AAMVA *Best Practices Guidelines for the Use of Magnetic Stripes*
PC/SC Workgroup Specifications Versions 1.0 and 2.0

ID TECH Documents

80064502-001 SPT3 Memory Card Manual
80064503-001 SPT3 Down Load Manual
80064506-001 SPT3 Returned Statuses Manual

2.2. Applicable Links

AAMVA™	http://www.aamva.org/
EMV™	http://www.emvco.com/
ID TECH®	http://www.idtechproducts.com/
MSDN™	http://msdn.microsoft.com/library/
PC/SC	http://www.pcscworkgroup.com/
Windows Logo	http://www.microsoft.com/whdc/winlogo/default.mspx
OPOS	http://monroecs.com/opos.htm
ISO documents	http://www.iso.ch/

Note: All numeric characters are presented in hexadecimal, except numbers in single quotes are in ASCII.

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3. QUICK START

3.1. Quick Start Versions

The version of the quick start depends on the hardware and firmware of the reader being connected. Generally there are two types of readers those that appear to the application as a PC/SC reader and those that appear to the application as a COM device. The table below defines the type by part number SPT3 8xx or SPT3 5xx.

	part number	type	firm-ware	description
4	SPT3 84x or 54x	USB RS232	SPT3 s	USB reader using FTDI driver. compatible with Windows 98SE, ME, 2000 and XP (32 bit).
5	SPT3 85 or 55x	USB CDC	SPT3 c*	USB reader using Microsoft's standard Communication Device Class driver for Windows 2000 and XP.
6	SPT3 86x or 56x	RS232 PC/SC	SPT3 s	Serial reader with ID TECH'S PC/SC driver. This reader can operate as serial reader. OS Windows 2000 and XP.
8	SPT3 88x or 58x	RS232	SPT3 s	Standard serial reader no driver required will work in any operating system supporting a serial port. Cannot do PC/SC.
9	SPT3 89x or 59x	USB PC/SC	SPT3 u*	USB reader using ID TECH'S USB PC/SC driver for Windows 2000, XP and XP embedded.

*These readers have identical hardware the only difference being which firmware is loaded.

3.2. Required Equipment

1. For PC/SC a PC running Windows 2000 or Windows XP with an available USB port or DB9 serial communication port configured for plug and play, with CDROM or internet.
2. For Non-PC/SC a PC running Windows 98SE, ME, 2000 or XP with an available USB port or and RS232 port (DB-9) and any computer.
3. ID TECH SPT3 hybrid reader in default configuration.
4. Supplied USB cable or RS232 serial cable.
5. If RS232 the supplied 5 volt wall hugger power supply appropriate for your location.
6. Supplied sample T=0 microprocessor smart card.
7. Supplied CD-ROM containing drivers, demonstration programs, documentation, etc.

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3.3. Installing Drivers

If a SPT3 reader was ever installed it will install without prompting for the driver installation disk. The reader should be up and ready to work, go to the install demonstration software. If running a RS232 reader in non-PC/SC mode no driver is required, go to 3.4 Demonstration on page 17. If installing a PC/SC reader go to 3.3.1 Install PC/SC Driver page 14. If installing a USB-FTDI reader go to 3.3.2 Install FTDI Driver page 15. The final choice is installing USB-CDC driver go to 3.3.3 Install CDC Driver page 16.

3.3.1. Install PC/SC Driver

The ID TECH PC/SC drivers were designed for Windows 2000®, Windows XP® (32 bit) and Windows XP embedded systems. Drivers connect a SPT3 USB or RS232 to the operating system. The following installation instructions assume the reader is being installed on Windows XP, the instructions for Windows 2000 will vary somewhat.

If USB PC/SC Reader

1. Connect USB cable between SPT3 and PC.
2. When the new hardware found balloon displays select it.
3. The found new hardware wizard will display.
4. Accept the default, “Install Software Automatically.”
5. At the next prompt “If your hardware came with an installation CD or floppy insert it now.” If not already done insert the provided CD.
6. At the last prompt, “Your device has been successfully installed,” click finish.
7. Go to 3.4.1 PC/SC Demonstration on page 17.

If RS232 PC/SC Reader

1. Connect RS232 cable between SPT3 and PC. Plug wall hugger power supply to external power and connect power jack to back of the DB9 connector and boot or reboot PC. (Instead of rebooting the user can also scan for new hardware. Insert the CD that came with your hardware. To scan for new hardware select ‘Start’ [then ‘Settings’] then ‘Control Panel’ [then ‘Performance and Maintenance’] then [‘Printers and other Hardware’] then ‘Add Hardware’ then ‘Next’ then ‘Add/Troubleshoot a device’ then click Next). Items in square brackets maybe required depending on your windows configuration settings.
2. When the new hardware found balloon displays select it. (If the PC boots without detecting new hardware, it is probably not configured for plug and play. If the LED remains amber after the PC has booted this is the case. See instructions 11.6 Configuring PC to Support Serial Plug and Play, page 85).
3. The found new hardware wizard will display. To the prompt can Windows connect to Windows update to search for this software, select “yes—this time only.” Then click Next.
4. If prompted, “If your hardware came with an installation CD or floppy insert it now.” Insert the provided CD. This is only necessary if your PC was unable to contact the Microsoft site and download the correct driver.

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5. If prompted 'This wizard helps you to install software for: “ID TECH Spt3 Hybrid EMV Card Reader,”' Leave the default check box “Install the software automatically (Recommended)” and click Next. Wait while the PC finds the proper driver to install and installs it.
6. At the last prompt, “The wizard has finished installing the software for: “ID TECH Spectrum II Magstripe and EMV Card Reader” click finish. The reason the wizard says that Spectrum II reader installed is because the RS232 PC/SC driver is identical between the Sp2 and SPT3.
7. Select ‘Start’ [then ‘Settings’] then ‘Control Panel’ [then ‘Performance and Maintenance’] then ‘Administrative Tools’ then ‘Services’. Then scroll down to smart card. Verify that the Smart card service is started and that the start-up type is automatic. You can do this by double clicking on the word smart card, then select automatic and start the smart card service if the status says that it is stopped, and then click OK. Items in [] are optional depending on how your PC is configured.
8. At this point the readers LED should be off. Proceed to install the demonstration program.
9. Go to 3.4.1 PC/SC Demonstration on page 17.

3.3.2. Install FTDI Driver

1. Connect USB cable between SPT3c and PC.
2. When the new hardware found balloon displays select it otherwise you should see “Welcome to the Found New Hardware Wizard”.
3. To the prompt “Can Windows connect to Windows Update to search for software?” select “No, not this time” then click Next.
4. At the next window “If your hardware came with an installation CD or floppy disk, insert it now.” Insert provided CD into the CDROM drive, select “Install from a list or specific location (Advanced), and then click Next.
5. At the next window “Please choose your search and installation options,” select “Don’t search, I will choose the driver to install” and then click Next.
6. At the next window “Select the device driver you want to install for this hardware” select “Show all devices” and then click Next.
7. At the next window “Install all from Disk”, Click “Browse…” Browse to the CDROM drive \drivers\80035802-300-IDT USB Serial Driver …
8. At the next window “Locate a File,” specify the driver location where the IDT USB serial Driver V3.0 is located, select FTDIBUS.inf and then click Open.
9. At the next window “Select the device driver you want to install for this hardware” select “ID TECH USB High Speed Serial Converter” then click Next.
10. At the prompt “the software you are installing is not signed,” click “Continue Anyway.”
11. At the last prompt, “The wizard has finished installing the software for ID TECH USB High Speed Serial Converter” click Finish.
12. The Found New Hardware Wizard Pops up again, following the above procedures select a different driver file at the prompt “FTDIPORT” and click Open.

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13. Copy files from CDROM drive\drivers\80035802-IDT USB Serial Driver V…" and click OK.
14. At the next window "Select the device driver you want to install for this hardware" Select "ID TECH USB Serial Port" and click Next.
15. At the prompt "the software you are installing is not signed," click "Continue Anyway."
16. At the next prompt, "The wizard has finished installing the software for ID TECH USB Serial Port" click Finish.
17. At the last screen Windows has finished installing new devices. The software that supports your device requires you restart your computer. Do you want to restart?" Click yes.

When the installation of this program is complete the Spectrum readers LED should be green. Select 'Start' [then 'Settings'] then 'Control Panel' [then 'Performance and Maintenance'] then 'System' then 'hardware' then 'device manager' then 'ports' and note to which COM port the SPT3 is connected. Keep track of the port number, as this will be important when connecting the demo program to the reader. Go to install the demonstration software install \demo\HRDLL_Demo\setup.exe and follow the instructions. Go to 3.4.2 Non-PC/SC Demonstration on page 18.

3.3.3. Install CDC Driver

1. Connect USB cable between SPT3c and PC.
2. When the new hardware found balloon displays select it otherwise you should see "Welcome to the Found New Hardware Wizard".
3. To the prompt can Windows connect to Windows Update to search for this software, select "no, not at this time" then click Next.
4. At the next prompt "If your hardware came with an installation CD or floppy insert it now." Insert the CD into the CDROM driver and select "Install the software automatically (Recommended)" and then click Next.
5. At the prompt "the software you are installing is not signed," click "Continue Anyway." (The CDC driver is a standard Windows provided driver; ID TECH provides only the file to define the Spectrum III device).
6. At the last prompt, "The wizard has finished installing the software for ID TECH SPT3 USB RS232 Smart Card Reader" click Finish.
7. After installing the driver, the SPT3's LED should be green. Select 'start' [then 'Settings'] then 'control panel' [then 'Performance and Maintenance'] then 'system' then 'hardware' then 'device manager' then 'ports' and note to which COM port the SPT3 is connected. Keep track of the port number, as this will be important when connecting the demonstration program to the reader. Continue to install the demonstration program.
8. If necessary because a required application can only access certain ports, one can change the COM port number. Follow these steps select 'Start' [then Settings'] then 'Control panel' [then 'Performance and Maintenance] then 'System' then 'hardware' then 'Device Manager'. In the Device Manager under Ports double click on the SPT3c driver link (IDTECH SPT3 USB-RS232 Smart Card Reader (COM5). Select the "Port Settings" tab then select advanced. The currently selected port will display, selecting it will allow a

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different port to be chosen, 'another' port can be selected even if it says that the port is in use (some care should be exercised to avoid selecting a port actually in use). After selecting the new port, select OK then OK. Then scan for hardware changes and the new port should display.

3.4. Demonstration Programs

If installing a COM device or non-PC/SC reader see 3.4.2 Non-PC/SC Demonstration page 18, the PC/SC reader demonstration application instructions immediately follow.

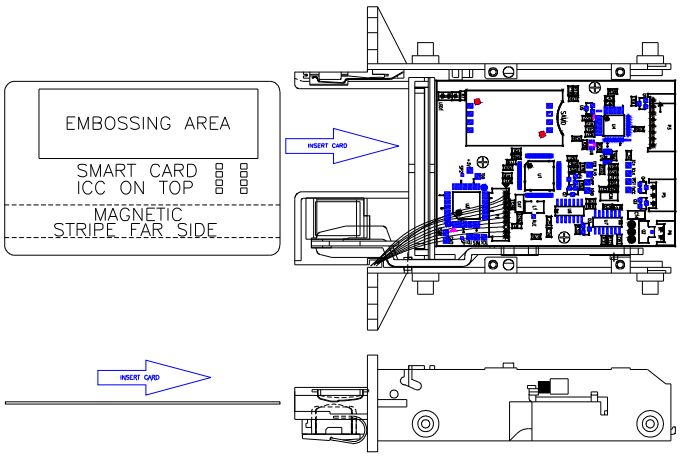

Figure 1 – Orientation for Inserting Card into Reader (Standard chassis shown)

3.4.1. PC/SC Demonstration

Run the demo from the supplied CD by exploring to \demo\SPT3CppPcscDemo V2.0.1.0\release and double clicking on SPT3CppPcscDemo.exe the icon that looks like a smart card reader. Note a PC/SC reader must be connected or the program will report no smart card reader available. If there is a problem, install in the SPT3CppPcscDemo by double clicking on \Demo\SPT3CppPcscDemo V2.0.1.0\setup\Setup.exe and following the instructions. Once the demo is installed, select 'start' then 'all programs' then 'IDTECH' then 'SPT3CppPcscDemo' to run program. If everything is functioning properly the firmware, DLL and driver version information will display. To demonstrate that the smart card works, fully insert the provided sample microprocessor card (see card orientation figure above), and then select 'Connect Card'. To demonstrate that the card is functional, enter "00 A4 00 00 02 31 40" in the command box, and then select 'Send APDU' to card. This will select file 3140. One should get a "9000" status response from the card. Clear previous command. To read the first 4 bytes of that file enter "90 52 00 00 04" in the command box, and then select 'Send APDU'. You can check the response window to see the four bytes of response and two bytes of status 90 00. To demonstrate that the magnetic stripe reading works, select 'Disconnect', the message windows will say "context release successful". Then select 'Connect Rdr' and fully insert a magnetic stripe card. Select "Get Magstripe Data" button and then within 30 seconds

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pull the card in one clean motion from the reader. The contents of the cards tracks 1, 2 and 3 will display in the response area. To do a quick test of the readers functions select 'hardware test' and following the prompts using the sample microprocessor card when prompted to insert a valid test card. This verifies that the card seated switch and the latch are functioning properly. Withdraw the card as prompted to verify all three magstripe tracks are reading properly. This verifies that smart card reading and writing are functioning properly and that all three magnetic stripe tracks are reading properly.[2]

3.4.2. Non-PC/SC Demonstration

Install the HR_DLL Demo. To do this, in the provided CDROM, double click on the install program at \Demo\DLL-Demo-V4.1 041124\Setup.exe. Follow the on screen prompts to install it. There is a document describing this program on the CD-ROM at \Manuals\HrDLL_Dynamic_Link_Library_454.pdf.

3.5. FAQ (Frequently Asked Questions)

1. **How do I install a Spectrum III reader?**
   Follow the instructions at QUICK START on page 13

2. **When starting the SPT3CppPcscDemo, I get the error message: Function SCardListReaders returned 0x8010002E error code. No smart card reader available.**
   The operating system does not recognize an RS232 smart card reader attached to it if the PC has not been rebooted since attaching the reader, reboot the PC and see if the problem goes away. If the reader SPT3s in PC/SC mode, the PC in may not be in plug and play mode, if the LED is amber this is the case. See instructions under 11.6 Configuring PC to Support Serial Plug and Play page 85 for help correcting this situation. If not verify in the control panel that there is a PC/SC reader attached. If an RS232 reader was detached and reattached see instructions 11.5 Reconnecting a Disconnected Reader page 85. If the reader is a USB reader it probably does not have PC/SC firmware loaded.

3. **When starting the SPT3CppPcscDemo program I get the error message: Function SCardEstablishContext returned 0x8010001D error code.**
   The Smart card resource manager is not running. See instructions 11.4 configuring the Smart Card Service page 85.

4. **When a command is sent to the reader the status code XXXX is returned, what does this mean?**
   For a condensed list of reader status codes see – Response Status Code Summary and Explanation Table page 51. There is a separate document included with this manual called SPT3_returned_Status.doc. This document gives a complete list of all the codes returned by the SPT3 with a description of what the error code means. The SPT3CppPcscDemo will automatically display these statuses with their meaning. Note the card or driver may return

[2] The RS232-PC/SC driver disables the card present switch.

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an error status as well for a list of PC/SC driver error statuses see – SCARD Error to Value page 60. ICC error statuses can generally be found in ISO-7816-4.

5. **Does the SPT3 support my card?**
   The SPT3 supports all T=0 and T=1 microprocessor cards. There is one reader setting that affects microprocessor cards depending on whether the particular card supports or conflicts with the EMV specification. If your microprocessor card fails to work see page 36, the default setting restricts many cards incompatible with EMV, but that will work fine in a non-EMV situation. The SPT3 support a wide variety of memory cards, for a summary list of types of memory cards supported see Memory Card Commands page 47. There is also a separate memory card manual included with this manual that gives more information on the types of memory cards supported. In the SPT3CppPscsDemo Changing the default mode of the reader from EMV cards to ISO cards can be done by selecting the button Configure for ISO Card. To restore the reader to the original state select Configure for EMV Card.

6. **The LED operation is different from the Sp2, why and how do I make it the same?**
   The LED operation is different because some considered the LED distracting or confusing. The LED can be made to operate like the Sp2 see Set Compatibility Mode page 38. For a description of how the LED now operates when controlled by the reader see LED Handling page 23.

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4. PC/SC GENERAL DESCRIPTION

4.1. Purpose of PC/SC

The purpose of PC/SC is to simplify the integration smart cards and the operating system. (ID TECH currently only supports PC/SC on Windows 2000 and Windows XP). It does this by creating a common application interface to smart cards. What that means is it makes the application independent of reader manufacturer. If one writes an application to access an ICC in one manufacturers reader then the same application should be able to access that card though any PC/SC smart card reader. PC/SC also makes the application somewhat independent of card manufacturer. PC/SC is not a full solution for a reader that includes features beyond smart cards. The insufficiencies of PC/SC v1.0 when using a hybrid reader include:

1. No built in support for Magnetic stripe reading
2. No built in support for card latching
3. No built in support for memory cards
4. Requires a “seated” smart card for normal operation
5. Access to reader only through the Personal Computer/Smart Card interface
6. No support for SAM cards.

The supplied IDTLIB.DLL deals with all of these problems and makes interfacing to these functions seamless to the application.

This reader only supports PC/SC version 1.0. The draft specification for PC/SC version 2.0 is available but the reader and driver do not support this version at this time.

4.2. EMV verses PC/SC

The EMV certification does not require PC/SC and PC/SC certification does not require EMV to some extent the certifications are incompatible. The purpose of EMV is to support reliable truly interoperable financial transactions, while PC/SC purpose is to support easy connection between a PC and smart cards. PC/SC certification requires support for a range of cards that are incompatible with EMV. To handle this, the reader has a configuration setting EMV/ISO. A reader configured for EMV (the default), supports only a subset of the cards supported by the SPT3 reader. A reader configured for ISO cards may not properly handle certain EMV transactions.

The banking industry generated the EMV specification to provide true interoperability between a wide variety of smart cards and readers. EMV certification is frequently required for certified banking applications. EMV is a detailed specification based on ISO 7816, but EMV is more restrictive and requires extensive certification testing. Europay, MasterCard, and Visa created this specification and it defines guidelines for debit and credit transactions. If the financial system, in which the ID TECH reader is incorporated, requires EMV certification, our reader is EMV level I certified. The system with the reader incorporated in will have to undergo EMV level II certification. The certification is to EMV 4.0.

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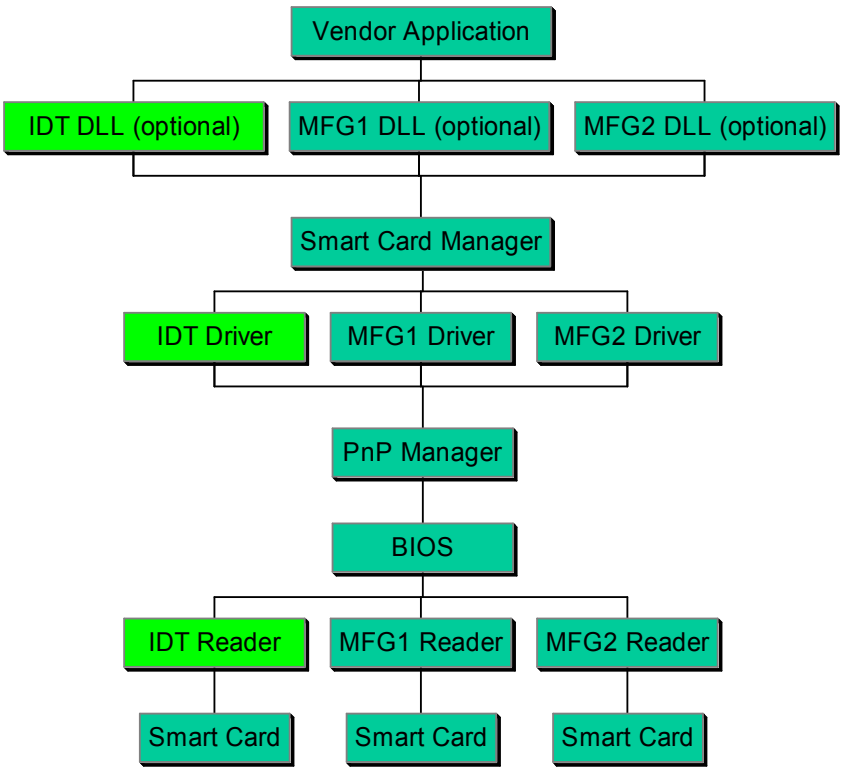
ISO 7816-3 is a limited specification to which all microprocessor cards are designed. ISO 7816-3 does not require certification. The purpose of this specification is to provide microprocessor card access.

4.3. IdtLib.dll

Purpose of the IdtLib.dll is to simplify access to reader/vendor specific functions like magnetic stripe reading and latch control in a PC/SC environment. This library is not required: all functions can be done by the application without this DLL. The purpose of the supplied DLL is to simplify use of the reader's features by an application program.[3] It is compatible with the program of the same name provided with the Sp1 and Sp2.

4.4. How the Various Parts of the PC/SC Fit Together.

Figure 2 – Simplified PC/SC Component Organization



[3] A newer DLL is required that one provided with the Sp1 or Sp2.

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5. HYBRID READER—GENERAL AND ICC

5.1. Operation

The ID Tech Hybrid Reader is easy to operate. Make sure the reader is properly connected and receiving sufficient power. If non-PC/SC reader, the green LED indicates it is ready to read (if the LED is in reader control mode).

5.1.1. Smart Card Features

Supports 5, 3 and 1.8 Volt T=0 and T=1 microprocessor cards and many memory cards. The reader has automatic hardware protection for card removal, ESD, supply voltage drop, and short circuit. This unit reads from and writes information to IC cards compliant to ISO 7816 standards. The reader communicates depending on model using a RS232 or USB interface for both ICC and magnetic cards. Landing style contacts provide for long card life.

5.1.2. Magnetic Card Read Modes

The SPT3 supports two MSR modes.

“Auto Transmit mode” – Reader sends data as soon as the data is available. When using “Auto Transmit Mode”, the application program needs to be ready to receive data. Auto Transmit mode is not compatible with ID TECH’s PC/SC drivers.

“Buffered Mode” – The application program first sends an “Arm to Read” command to enable the magnetic stripe reading. Second, the user inserts and withdraws a Magstripe card, the decoded data is stored, third the readers notifies the host a Magstripe read occurred, and MSR is disarmed. The application program then sends a “Read MSR Data” command to retrieve the data from the buffer. When operating in PC/SC mode, the reader only supports buffered mode. Do not try to change this.

To read a magnetic stripe card, just follow these simple steps, LED indication describes LED status change when it is under the control by reader:

5.1.3. Latch Operation

The Latch is an option feature and is not available on every reader. The latch is locked (latched) and unlocked by command. The latch can be locked only when a card is fully seated. A card can be forcibly removed without damage to the latch. If there is a power line voltage failure, the card is automatically unlatched using power reserves from the capacitors in the power supply output circuits. If the power supply is not capable of reserve power, an external capacitor must be connected to the reader PCA. This capacitor is part number 80059215-001. There is a connector on the PCA for this capacitor when ordered with the option.

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Insert the card, magnetic stripe down, into the reader until it hits a hard stop, (note if reader is configured for read on insert (the default is on withdrawal) it is important to insert the card in one continuous motion to insure proper reading of the data). If the reader is a non-PC/SC reader as soon as it detects data from magnetic stripe, the green LED indicator will go off.

When the card has been inserted all the way (hits the hard stop), the green LED will light again if operating in Sp2 LED compatibility mode.

Withdraw the card in one continuous motion. The green LED will go off again. (The reader is capable of reading a magnetic stripe on both insertion and withdrawal, but a more reliable read is normally experienced on withdrawal.)

If the reader controls the LED, the LED will turn red (to indicate a bad read) or green (to indicate a good read) meaning it is ready for another transaction.

Configuring the reader to support auto transmit mode or buffered mode is done with MSR Transit Mode Setting [53 1A] page 56.

5.1.4. Smart Card Access

To read a smart card, just following these simple steps:

- Insert the smart card into reader as far as it will go. For orientation see figure on page 17.
- Use smart card commands to communicate with reader after the card has been inserted all the way.
- See Example T=0 Read [61] and Write [41] Commands to Card page 43.

5.1.5. LED Handling

LED handling can be under the control of the reader or under the control of the host computer. The default operation is to have the LED under the control of the reader.

- On powering the reader the LED will flash red then green to indicate a successful start-up.
- For an RS232 reader in PC/SC mode, the LED will turn to amber after power up until the host plug and play “COM enumerator” detects the reader.
- The LED will flash amber on start-up if the configuration EEPROM has a problem.

LED handling in reader controlled mode

LED operation depends on whether the reader is in Auto-transmit or Buffer Mode. Auto-transmit is the default state unless the reader is in PC/SC mode then its default state is Buffered mode.

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LED handling in buffered mode

- The LED will turn green if the reader is armed to read a magstripe card.
- The LED will turn off if it is not armed to read a magstripe card or has just read a card.
- The LED will turn red to indicate that the recent magstripe card read was bad.

LED handling in auto-transmit mode

- The LED will turn green before smart card is powered on or after smart card has been powered off unless the reader is reading or just read a Magstripe card.
- The LED will turn off after powering 'on' the smart card.
- The Green LED indicates the smart processing is complete and the ICC powered off. The user can remove the smart card.

LED handling in host controlled mode

If the LED is under the command of the host the following settings are available.

- Turn the LED off
- Turn the LED on Green
- Turn the LED on Red
- Turn the LED on Amber
- Set the LED to Green Flashing
- Set the LED to Red Flashing
- Set the LED to Amber Flashing
- Set the LED to Flashing Red and Amber

Flashing rate is approximately .25 seconds on and .25 seconds off. Regardless on whether the LED is under the command of the host, the LED will still signal certain errors and start-up conditions. If configured for RS232 and Plug-and-Play, the LED will be amber until the reader has sent its plug-and-play string to the host. If there is a problem on first start-up with configuring the EEPROM the LED will hang flashing amber.

5.1.6. Lighted bezel option (4 LEDs)

In readers with the lighted bezel option, the 4 LEDs function identically to the single LED operation as described above and are operated through the Green LED commands. For example, the command to light the LED green, all 4 LED will respond with green light simultaneously.

Configuring the reader to support host controlled LED commands is done with 5.4.6 Set Operation Mode [53 11] command, page 36. The host controls the LED with Host LED Control Command, page 29.

To configure the reader to handle the LED like the SPT2, see 5.4.7 Set Compatibility Mode page 38.

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5.1.7. Card Status Notification [B0 xx] or [2F 00]

There are six notifications the reader can issue. One is an error notification, the other five are optional card seated, card unseated notification, optional card present, card removed notification, and optional buffered magnetic stripe data available.

The reader issues an “error notification” (E0 00 02 2F 00 CD 03), if an IC card was removed while powered.

The reader can issue a “card notification” (60 00 02 B0 XX YY 03), if “card seated, card unseated, card present, card removed or buffered magnetic stripe data available notification” has been set to on and there has been a change to a card is fully inserted or present, or there is buffered magnetic stripe data available. The value of XX is the value of the status byte see 5.3.2 Get Reader Status [24] page 28. Each bit in this byte holds the current status of one piece of information: bit 0—card powered; bit 1—card seated; bit 2—card latched; bit 3—card present; and bit 4—magnetic stripe data available.

Configuring the reader to send or not send notifications is done with 5.4.6 Set Operation Mode [53 11] command, page 36. If the reader is operated in PC/SC mode does not change the card seated and buffered Magstripe data available notification settings, because the driver requires these notifications to function properly.

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5.2. Communication Structure

This section defines the command format for communicating with the reader.

Turbo TLP-224 Protocol for Sending Commands and Receiving Responses

5.2.1. Host Command

All commands originate at the host and expect a response from the reader.

60 <Length> <Command ID> [<Command Data>…] LRC 03

Where:

<Length> = is a two-byte counter from <Command ID> to the end of <Command Data>.

<Command ID> = is a one byte value identifying a specific command ID, see command Table 1 – Reader Command ID Summary page 28 and Table 4 – Reader Command IDs Affecting Smart Card Summary page 39.

<Command Data> = is the data block associated with the command. See details under each individual command description.

5.2.2. Reader Response

All responses come from the reader in response to a command from the host.

60 <Length> [<Response Data>] <Status> LRC 03

Where:

<Length> = is a two-byte counter from <Response Data> to the end of <Status>.

<Response Data> = is the data block associated with the Response. See details under each individual command description.

<Status> is a two byte value indicating the success or failure of a command. See Table 5 – Response Status Code Summary and Explanation page 51.

The overall LRC (Modulus 2 = Exclusive OR) checksum (from 60 to LRC) should be zero. See 5.2.3 Example of LRC Calculation on page 27.

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5.2.3. Example of LRC Calculation

Note: SPT3c and SPT3u firmware do not set or check the LRC value, but a place holder character is required. The USB protocol assures the integrity of the message. LRC = Longitudinal Redundancy Check. Calculated by taking 'Exclusive OR' (Modulus 2) of all characters preceding it, total with LRC is equal to zero.

Example: Calculation of the LRC character

The following memory card command means read 16 bytes of data from address 0000:
60 00 06 42 DA B0 00 00 10 5E 03

'5E' is the LRC character and it is derived as follows:

Characters	#1 (binary)	#2 (binary)	
60	0110	0000	
00	0000	0000	
06	0000	0110	
42	0100	0010	
DA	1101	1010	
B0	1011	0000	
00	0000	0000	
00	0000	0000	
10	0001	0000	
5E	0101	1110	Result of Exclusive 'OR'

5.2.4. Communication Timing

Maximum delay for the reader to respond to a read configuration command is 5 ms. typical delay is 2 ms.

Maximum delay for the reader to respond to a write configuration command is 20 ms. Typical delay is 5 ms.

During the command processing time, the reader will not respond to a new command. The reader will accept a new command as soon as it has responded to the previous command.

Smart card reads and writes timing can very substantially between cards. By the specifications a smart card may take as long as a minute to complete a command, so the host application should be prepared to wait 60 seconds before retrying a slow smart card access command if worst case timings need to be considered.

Note: Maximum delay between two characters in a command is 100ms.

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5.3. General Reader Commands Description

Table 1 – Reader Command ID Summary				
ASCII	**Page**	**HEX**	**Name**	**Use**
'$'	28	24	Reader Status Report	Request reader status byte
'8'	30	38	Copyright Report	Requests reader's copyright notice
'9'	26	39	Version Report	Requests version string
'I'	30	49	Reader Reset	Reset the reader
'L'	42	4C	Latching Functions	Latching and Unlatching Card
'P'	54	50	Arm/Disarm	Arm to Capture Buffer Mode MSR
'Q'	55	51	Read Buffered Data	Read Stored MSR Data
'R'		52	Read Options	Read various reader optional settings
'S'		53	Set Options	Set various reader optional functions
'l'	30	6C	Led Functions	Turning on/off/flash the bicolor-LED
'z'	30	7A	Enter downloader	Upgrading Firmware

5.3.1. Get Firmware Version Description [39]

60 00 01 39 58 03

Note: An approximately '55-byte' version description will be returned. The description and length varies somewhat by hardware.

Response is as follows:

60 <Length> <Version Description> LRC 03

Response Example (mixed hex and ASCII):

60 00 31 "ID TECH Spectrum 3 USB Reader v1.00 040802" 0B 03

The 040802 is the date of the firmware version 2 August 2004 (format YYMMDD).

5.3.2. Get Reader Status [24]

60 00 01 24 45 03

The Status byte returned is defined as follows.

Bit Position	**'0'**	**'1'**
0	ICC Power not ready	ICC Powered
1	Card not seated	Card seated
2	Latch released	Latch closed*
3	Card not present	Card present*
4	No magnetic data	Magnetic data present
5~7	Unused all 0	

* Note: flag is always 0 unless reader has the specific option.

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Magnetic data present flag is always 0 if a reader is set in “Auto Mode”.

Response is as follows:

60 00 01 <Reader Status> LRC 03

Response Examples:

60 00 01 00 61 03 no card present
60 00 01 08 69 03 card present
60 00 01 0A 6B 03 card present and seated
60 00 01 0B 6A 03 card present, seated, and powered
60 00 01 0E 6F 03 card present, seated and latched

5.3.3. Latch Close Command [4C 01]

60 00 02 4C 01 2F 03

Use this command to close the latch and entrap the card.
Note: Reader must have the “latch” option on the reader to use this command.
Note: A card must be seated in the reader to close the latch.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

2A00 latch failed to close
2C07 no card seated to latch
6900 latch function subtype must be 0 or 1
6901 reader is not configured with latch hardware

5.3.4. Latch Open Command [4C 00]

60 00 02 4C 00 2E 03

Use this command to release the latch and allow the card to be removed.
Note: Reader must have the “latch” option to support this command.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

2A08 latch failed to open
6900 latch function subtype must be 0 or 1
6902 reader is not configured with a latch

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5.3.5. Host LED Control Command [6C]

60 00 02 6C <LED Command> LRC 03

This command is used to change the color setting on the LED.
Note: Reader must have the "LED" option under host control for this command function properly.
Where <LED Command> are:

ASCII	Hex	Action	
'0'	30	LED will be turned off.	
'1'	31	LED will be turned on green.	
'2'	32	LED will be turned on red.	
'3'	33	LED will be turned on amber.	
'4'	34	LED will be flashing red/amber.	NEW
'5'	35	LED will be flashing green.	NEW
'6'	36	LED will be flashing red.	NEW
'7'	37	LED will be flashing amber.	NEW

Example: To flash the LED green:
60 00 02 6C 35 3B 03

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03
Other possible response statuses:
6913 2nd byte of LED command must be 30-37
691F host LED control not enabled. To configuring the reader to support host controlled LED commands see 5.4.6 Set Operation Mode [53 11] command, page 36.

5.3.6. Reader Reset Command [49]

60 00 01 49 28 03

The reader supports a reset reader command. This allows the host to return the reader to its default state, i.e. card not powered, not armed to read, latch open, no magnetic or ICC data stored, etc. The reader remains on-line. This won't reset any of the readers' configuration settings.

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

5.3.7. Get Copyright Information [38] NEW

60 00 01 38 59 03

Response is as follows:
60 00 3F <Copyright String> LRC 03
Response Example mixed hex and ASCII:
60 00 3F Copyright (c) 2005, International Technologies & Systems Corp. LRC 03

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5.3.8. Enter Downloader (Upgrade Firmware) [7A] NEW

60 00 01 7A 1B 03

If the reader is able to enter the downloader it flashes the LED red, green, dark and acknowledges the command. The reader is then ready to receive download commands typically for firmware upgrading. See Download Manual first.

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03 or
691D download code missing or corrupt.

5.4. Reader Configuration Commands Description

5.4.1. Restore Configuration Settings to Default [53 18]

60 00 02 53 18 29 03

This command restores most settings to their default value. See Table 2 – Default MSR Configuration Settings page 31, for default values. Note: Executing this command does not affect the operations mode (page 36), or the serial number.

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

Default Configuration Settings

Table 2 – Default MSR Configuration Settings

SETTING	DEFAULT
MSR Reading	Enabled Auto Mode*
Magnetic Decoding Method	Withdraw Only
Send Option	Send Start/end Sentinel
Terminator Settings	CR (Hex OD)
Prefix Setting	None
Suffix Setting	None
Track Selected Settings	Any Track
Track Separator Settings	CR (Hex OD)
Baud Rate Setting	38400 bps
X-On Character Setting	DC1 (Hex 11) unused
X-Off Character Setting	DC3 (Hex 13) unused
Track 1 ID	None
Track 2 ID	None
Track 3 ID	None
Operations Mode	MSR Enveloped, MSR data present notification off*, Standard Decoder
IC Card Type	5V Microprocessor Card
Memory IC Card Type	Type 0 3-byte I^2C Card

*PC/SC driver changes this to Buffered Mode & magstripe data notification on.

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5.4.2. Read All Configuration Settings [52 1F]

60 00 02 52 1F 2F 03

This command does not have any <FuncData>. It retrieves all current settings. The Spectrum 3 reader sends back an <ACK> and <Response>.

<Response> format:

The current configuration data block is a collection of many Function-Setting blocks <FuncSETBLOCK> as follows:
60 <Length> <FuncSETBLOCK1>…<FuncSETBLOCKn> LRC 03

Each Function-Setting block <FuncSETBLOCK> has the following format:
<FuncID> <Len> <FuncData>

Where:
<Length> is a two bytes counter, which indicates bytes of all <FuncSETBLOCK>. The most significant byte comes first.
<FuncID> is a one byte Function ID identifies the setting(s) for the function. For a complete list of FuncID see Table 3 – Configuration Function ID Summary and Explanation page 33.
<Len> is a one-byte length count for the following function-setting block <FuncData>.
<FuncData> is the current setting for this function. It has the same format as in the Sending Command for this function. See SENDING COMMAND LIST for details.
<FuncSETBLOCK> are in the order of their function ID <FuncID>.

Example:
60 00 51 10 01 00 11 01 0E 12 01 00 13 01 30 17 01 0D 19
01 31 1A 01 31 1D 01 33 1B 01 B8 21 01 31 41 01 37 47 01
11 48 01 13 31 01 00 32 01 00 33 01 00 61 02 C0 00 62 02
80 00 63 02 00 00 64 02 00 00 65 02 00 00 D2 01 00 D3 01
00 1C 02 BF 01 1E 01 00 5D 03

Example Interpreted:
60 00 51 ACK, length data: 0051 hex or 81 decimal.
10 01 00 10=card option—page 31, length 1, value 00
11 01 0E 11=operation mode—page 36, length 1, value 0E
12 01 00 12=memory card type—page 47, length 1, value 00
...
61 02 00 00 6n = Set SAM card option, See page 50, length 2, value 00 00
...
5D 03 LRC, ETX.

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5.4.3. Read Specific Configuration Setting [52 nn]

60 00 02 52 <Configuration> LRC 03

The <Configuration> byte corresponds to the byte from a specific configuration value.

All MSR reader Read Configuration Commands are listed in the following format:

60 00 02 52 <FuncID> LRC 03

For example to read the “Card Option” configuration send

60 00 02 52 10 20 03

Table 3 – Configuration Function ID Summary and Explanation

Function Description	Function ID	Function Value	Page
IC Card Option	10	Any Value	31
Set Operation Mode	11	Any Value	36
Memory IC Card Type	12	00 – 07H	47
Track Selected Settings	13	‘0’ – ‘7’	58
Track Separator Settings	17	Any ASCII Code	58
Send Option	19	‘0’ – ‘3’	56
MSR Reading	1A	‘0’ – ‘2’	56
Data Editing	1B	Not Used	
Magnetic Decoding Method	1D	‘1’ – ‘3’	56
Terminator Settings	21	CR/LF, CR, LF, None	56
Track 1 ID	31	Any ASCII Code	57
Track 2 ID	32	Any ASCII Code	57
Track 3 ID	33	Any ASCII Code	57
Baud Rate Setting	41	‘5’ – ‘9’	34
X-On ID	47	Not Used	
X-Off ID	48	Not Used	
Connector 0 setting	60	Any Value	50
SAM 1 setting	61	Any Value	50
SAM 2 setting	62	Any Value	50
SAM 3 setting	63	Any Value	50
SAM 4 setting	64	Any Value	50
SAM 5 setting	65	Any Value	50
Prefix Setting	D2	String	57
Suffix Setting	D3	String	57
Compatibility mode	1E	00 – 07H	38
Reader serial number	4E	8 Digits	31
Memory card page size	15	8, 16, 32, 64 or 128	47

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5.4.4. Set BAUD Rate [53 41] (RS232 only)

The RS232 interface has several programmable features so the SPT3s can be optimized for the user's application. These settings can be made through a basic set up defined in the following sections.

Note: A SPT3s operated in PC/SC mode must leave BAUD rate at the default because the driver only supports the default BAUD rate.

Note: Default settings are in bold and underlined

Baud-Rate	9.6K, 19.2K, **38.4K**, 57.6K and 115.2K
Data-Bits	8
Parity	None
Stop Bits	1
Hand-Shaking	hardware

The hybrid reader will set itself to operate at the last configured BAUD rate; the default is 38.4K bits/sec after power up. After connecting the application can choose from 9.6K, 19.2K, 38.4K, 57.6K and 115.2K bits/sec. Reader will turn to the set BAUD rate after sending the response to this set command. Application should turn to the new BAUD rate after receiving the response to ensure the communication between application and hybrid reader.

Set host to reader BAUD Rate Command
60 00 04 53 41 01 <BAUD Rate Setting> LRC 03

The <BAUD Rate Setting> byte is defined below:

ASCII	Hex	BAUD Rate
'5'	35	9600 bits/sec
'6'	36	19.2K bits/sec
'7'	**37**	**38.4K bits/sec**
'8'	38	56.7K bits/sec
'9'	39	115.2K bits/sec

All other values are reserved.

Example to set baud rate to 115.2K BAUD
60 00 04 53 41 01 39 4E 03

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

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5.4.5. Set Card Option [53 10]

60 00 04 53 10 01 <Card Option> LRC 03

The <Card Option> byte is defined as follows.

Bit Position	'0'	'1'	
0~2	Unused		
3	**1.8V Off**	1.8V On	NEW
4	**EMV Card**	ISO Card	
5	**3V Off**	3V On	
6	**5V On**	5V Off	
7	**Microprocessor Card**	Memory Card	

EMV card is subject to all the checks described on EMV 4.0 specification, and the card communication follows the specification.

For a microprocessor card if more than one voltage is 'on', the reader will try lowest voltage first then next higher and finally the highest when attempting to retrieve the ATR. Subsequent communication between the SPT3 and the ICC will continue to use the voltage at which the ATR was retrieved.

Memory card handling is different if both 3V and 5V options are 'on' the reader will only attempt to communicate at the lowest voltage i.e. 3V.

Note: The EMV vs. ISO setting may have to be properly set depending on the type of card accessed. If it is an EMV card involved in EMV transactions then it must be set to EMV. However, EMV is more restrictive than ISO and if the reader is configured to EMV mode then many cards will not function because the EMV forces the reader to be more restrictive than the ISO 7816 specification allows.

Example to set configuration access an ICC card at 5V, ISO, microprocessor card

60 00 04 53 10 01 10 36 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

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5.4.6. Set Operation Mode [53 11]

60 00 04 53 11 01 <Operation Mode> LRC 03

The <Operation Mode> byte is defined as follows.

Bit Position	'0'	'1'
0	PC/SC mode Off	**PC/SC Mode On**
1	Card Seated Change Off	**Card Seated Change On**
2	Card Present Change Off	**Card Present Change On**
3	MSR Data Envelop Off	**MSR Data Envelop On**
4	**LED Controlled by reader**	LED Controlled by Host
5	**Magnetic data present off**	Magnetic data present on **(default if PC/SC)**
6	**Standard decoder**	Raw magnetic data decoder
7	Unused	

For the SPT3s, PC/SC Mode On sets the reader to "Plug and Play." All USB readers ignore this setting, as they are always plug-and-play, but in a USB reader plug-and-play does not force to PC/SC mode. For details see Plug and Play Support (RS232 only) page 37.

For any reader operating in PC/SC mode do not change bits 1, 3 and 5 as the driver depends on these bits being on to function properly, the PC/SC driver checks and sets these bit as required when the reader first connects to the driver.

If "Raw data decoder" has been set, the reader treats all magstripe data as a bit string and sends it out in hex format. The reader suppresses leading and trailing zeros. All the read tracks data is sent with no regard to track designation or separation. No error checking is performed.

Note: The reader only reports magnetic data present notification when set to buffered mode.

A "Status change notification" (60 00 02 B0 <Card Status> LRC 03) is issued by the reader, if "Card Seated Change" or "Card Present Change" has been set on and card switch changed.

If the LED control bit is changed to host control, the LED is turned off.

After a good read, Magstripe data will be sent out enveloped (60 <Len_H> <Len_L> <Card data indication 1> <Card indication 2> <Magstripe data> LRC 03), if "MSR Data Envelop" is on, Otherwise magstripe will be sent out without an envelop <Card data indication 1> <Card indication 2> <Magstripe Data>). In PC/SC mode the Magstripe data is always enveloped.

<Card data indication 1> (<C0>) identifies a response as magnetic data.

<Card data indication 2> is flags about current read.

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Bit Position	'0'	'1'
0	Track 1 decode fail	Track 1 decode success
1	Track 2 decode fail	Track 2 decode success
2	Track 3 decode fail	Track 3 decode success
3	No Track 1 data	Track 1 data exists
4	No Track 2 data	Track 2 data exists
5	No Track 3 data	Track 3 data exists
6~7	Unused	

Note: Track 1, 2, or 3 decode flag is 0 if the track does not exist.

Note: The Operation Mode configuration byte is unchanged when the reader's configuration is reset to its default setting. The default setting as shipped from the factory is 0FH.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Plug and Play Support (RS232 only)

Reader will notify the operating system of its arrival by sending "Device ID String" at 1200 baud (1200, 7, 1, Mark), after the reader is power up or reconnected to the PC. The reader will only send this string if the operating system requests it. The operating system will only request the PnP string on boot and on scanning for hardware changes. To set an RS232 reader to PC/SC mode configure it for plug-and-play.

Plug-and-Play Device ID String:

(<01 22>ITS0020\[Serial Number]\\\ID TECH 0030 Hybrid Mag&EMV Card Reader [Check Sum byte 1][Check Sum byte 2])

[Serial Number] is an 8-byte string, represents serial number of a device.

[Check Sum byte 1] and [Checks Sum byte 2] are single byte check characters.

To change the reader from the default setting of PnP or to restore the PnP setting, see Section 5.4.6 Set Operation Mode [53 11] page 36.

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5.4.7. Set Compatibility Mode [53 1E] NEW

60 00 04 53 1E 01 <Compatibility Mode> LRC 03

The <Compatibility Mode> byte is defined as follows.

Bit Position	'0'	'1'
0	**Report errors as SPT3**	Report errors as Sp2
1	**Display LED as SPT3**	Display LED as Sp2
2-7	Unused, all should be 0	

The SPT3 reports each error status with a unique number. The Sp2 reports errors from multiple sources with the same error code. The high byte of the error code should be identical in each of these cases. The low byte of the error code as reported by the Sp2 is usually 0. The low byte of the error code from the SPT3 uniquely identifies the source of the particular error. The document (SPT3_Returned_Status) lists all the statuses and a description of their meaning.

The Sp2 displays an Amber LED when the reader is communicating with the card or with the host computer. The SPT3 does not use the LED to indicate communication with the card or with the host.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

5.4.8. Read Reader Serial Number [52 4E]

60 00 02 52 4E 7E 03

Note: An '8-byte' string of serial number will be returned.

Response is as follows:

60 00 0B 4E 09 08 <Serial Number (8 bytes)> LRC 03

5.5. Microprocessor Commands Descriptions

All ICC reader commands follow the Turbo TLP-224 protocol and use the ISO 7816-4 Application Protocol Data Unit (APDU) or 7816-3 Transport Protocol Data Unit (TPDU) structure to communicate with the IC card. Note: <length> is two bytes first byte is the most significant second is the least significant.

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5.5.1. Smart Card Commands Summary

Table 4 – Reader Command IDs Affecting Smart Card Summary

ASCII	Hex	Page	Name	Use
'A'	41	39	Output to a T=0 or T=1 microprocessor card	Write command (may include data) to a microprocessor (T=0 or T=1) card
'a'	61	43	Input from T=0 or T=1 microprocessor card	Read command to microprocessor card and waits for response data
'B'	42	47	Communicate with memory card	Command for accessing, reading and writing memory cards
'C'	43	49	Select ICC connector	Switches between User and SAM ICC connectors
'F'	46	44	Raw T=1 I/O with microprocessor card	Sends command to T=1 card & awaits response, host handles T=1 protocol.
'M'	4D	41	ICC Power OFF	Power off ICC card
'n'	6E	39	ICC Power ON	Power on microprocessor card, return ATR

5.5.2. Transmission Protocol for ICC Cards

Following are the command/response protocols for communication between the hybrid reader (ICC media) and host. The protocol used by this reader is turbo TLP-224. All commands and characters are presented in 'Hex'. Note: Maximum buffer size for read is 256 bytes and for write is 255 bytes.

Successful Command Response Sequence

Host to Hybrid Reader Command

60	LH LL	nnnnnnnnnnnnnnnnnnn	ZZ	03
ACK	length	data(C-APDU)	LRC	03

Hybrid Reader to Host Response

60	LH LL	nnnnnnnnnnnnnnnnnnn	SS	ZZ	03
ACK	length	data(R-APDU)	Status	LRC	03

Note: length is two bytes first byte is the most significant, second is the least significant.

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Unsuccessful Command Response Sequence

Host to Hybrid Reader Command

60	LH LL	nnnnnnnnnnnnnnnnnnnn	ZZ	03
ACK	length	data(C-APDU)	LRC	03

Hybrid Reader to Host Response

E0	LH LL	nnnnnnnnnnnnnnnnnnnn	SS	ZZ	03
NACK	length	data(R-APDU)	Status	LRC	03

Or

E0	LH LL	SS	ZZ	03
NACK	length	Status	LRC	03

The status either defines a successful transaction or gives an error code (see Table 5 – Response Status Code Summary and Explanation page 51).

5.5.3. Power On (Get ATR) Command [6E]

60 00 <Length> 6E [<Option>] [<PPS>] LRC 03

This command is used to power up the currently selected microprocessor card. It follows the ISO7816-3 power up sequence and returns the ATR as its response. Memory cards do not have an explicit power up command, i.e. any I/O operation sent to the card causes a power up.

<Option> and <PPS> are optional, but <Option> must be present if <PPS> is used.

Note: The <Option> byte is defined as follows.

Bit Position	**'0'**	**'1'**
0	**No IFS**	Send S(IFS) request if T=1 protocol
1	**No Explicit PPS**	Explicit PPS
2-5	Unused (all 0)	
6	**Auto PPS**	No auto PPS for negotiable mode
7	**IFS response check**	No check on response of S(IFS) request

<PPS> is to set the Protocol and Parameters Selection between card and reader, only Di <= 4 are supported. PPS must follow the structure specified in ISO 7816-3 as PPS0, [PPS1], [PPS2], and [PPS3]. Typically the <PPS> is two bytes long. For more information see ISO 7816-3 section 7.2.

Example:

60 00 04 6E 02 10 11 09 03
Where 02 is the <Option> 10 is PPS0 and 11 is PPS1

Response is as follows:

60 00 <ATR Length> <ATR string> LRC 03

Example:

60 00 15 3B 6F 00 00 80 25 A0 00 00 00 68 54 08 00 0B 00
82 90 00 90 00 99 03

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Other possible response statuses:

2C06 no card seated to request ATR
2D01 Card Not Supported,
2D03 Card Not Supported, wants CRC
690D command not supported on reader without ICC support
8100 ICC error time out on power-up
8200 invalid TS character received
8500 PPS confirmation error
8600 Unsupported F, D, or combination of F and D
8700 protocol not supported EMV TD1 out of range
8800 power not at proper level
8900 ATR length too long
8B01 EMV invalid TA1 byte value*
8B02 EMV TB1 required*
8B03 EMV Unsupported TB1 only 00 allowed*
8B04 EMV Card Error, invalid BWI or CWI*
8B06 EMV TB2 not allowed in ATR*
8B07 EMV TC2 out of range*
8B08 EMV TC2 out of range*
8B09 per EMV96 TA3 must be > 0xF*
8B10 ICC error on power-up
8B11 if EMV96 T=1 then TB3 required*
8B12 Card Error, invalid BWI or CWI
8B13 Card Error, invalid BWI or CWI
8B17 EMV TC1/TB3 conflict*
8B20 EMV TD2 out of range must be T=1*
8C00 TCK error
A304 connector has no voltage setting
A305 ICC error on power-up invalid (SBLK(IFSD) exchange
E301 ICC error after session start

*Connector is configured for EMV, but ICC is not a valid EMV ICC. To support this card in this connector change the configuration from EMV to ISO see 5.4.5 Set Card option [53 10] page 35. If connector is a SAM connector also see 5.7.4 Set SAM Card Option [53 6n 02] on page 50.

Please refer to Appendix C for the complete list of response codes.

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Power Off Command [4D]

60 00 01 4D 2C 03

This command is used to power down the current selected card. It works for both microprocessor and memory cards.

Note: If powering off an ICC in a SAM connector be aware all SAM connectors will be powered off.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6907 command not supported on reader without ICC support

5.5.4. ICC Reader Microprocessor Card Output Command Structure [41]

60 <length> 41 <APDU> LRC 03

This 41 command is used to pass a T=0 write or any T=1 APDU to a microprocessor card where for a T=0 card only an ISO status is expected.

See Example T=0 Read [61] and Write [41] Commands to Card page 43.
See Example T=1 Read and Write Commands to Card [41] page 42

Possible response statuses:

2C02 no microprocessor ICC seated
6903 reader configured without ICC support
9000 Success

Example T=1 Read and Write Commands to Card [41]

IBM PC/SC T=1 test card example (Card available from PC/SC workgroup).

Start the IDTECH PC/SC Sample demo program insert the IBM PC/SC T=1 card in the reader.

In the command window type the following commands in hex:

Command to set Card type as 5V, EMV, microprocessor card

60 00 04 53 10 01 00 26 03

Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Command to request ATR

60 00 02 6E 01 0D 03

ATR response should be

60 00 1A 3B EF 00 FF 81 31 86 45 49 42 4D 20 4D 46 43 34
30 30 30 30 38 33 31 43 90 00 D1 03

Command to Select File 0007

60 00 08 41 A4 A4 00 00 02 00 07 2C 03

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Response should be
60 00 10 63 0C 03 E8 00 07 00 00 00 FF FF 11 01 00 90
00 73 03

Write File 5 bytes from 0000
60 00 0B 41 A4 D6 00 00 40 00 01 02 03 04 1C 03
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

Read File 05 bytes from 0000
60 00 06 41 A4 B0 00 00 05 36 03
Response from the reader should be
60 00 07 00 01 02 03 04 90 00 F3 03

Command to power off the ICC
60 00 01 4D 2C 03
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

5.5.5. ICC Reader Microprocessor Card Input Command Structure [61]

60 <length> 61 <APDU> LRC 03

This 61 command is used to pass a T=0 read or any T=1 APDU to a microprocessor card where both data and an ISO status are expected from card.

See Example T=0 Read [61] and Write [41] Commands to Card page 43.
See Example T=1 Read and Write Commands to Card [41] page 42

Possible response statuses:
2C02 no microprocessor ICC seated
6903 reader configured without ICC support
9000 Success

Example T=0 Read [61] and Write [41] Commands to Card

If you use the ID TECH provided sample card labeled Microprocessor – 1K Byte P/N: 80005206-001. (If the reader has not been installed follow the installation procedure in section 3 QUICK START page 13).

Start the ID TECH PC/SC Sample demo program insert the T=0 sample card in the reader.

In the command window type the following commands in hex: In each of the examples the underlined portion of the command is the part that is entered. The rest of the command is the envelope, which is added automatically by the demo program.
Select File 3040
41 00 A4 00 00 02 30 40
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

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Verify CHV (samplepassword)
60 00 14 41 00 20 00 80 0E 73 61 6D 70 6C 65 70 61 73
73 77 6F 72 64 LRC 03
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

Write 8 bytes 12345678 to file 3040 address 0000
60 00 0E 41 00 D6 00 00 08 31 32 33 34 35 36 37 38 F9 03
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

Read 8 bytes from address 0000
60 00 06 61 00 B0 00 00 08 BF 03
Response should be
60 00 0A 31 32 33 34 35 36 37 38 90 00 F2 03

Write 8 bytes ABCDEFGH to address 0000
60 00 0E 41 00 D6 00 00 08 41 42 43 44 45 46 47 48 LRC 03
Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

Read 8 bytes from address 0000
60 00 06 61 00 B0 00 00 08 BF 03
Response should be ABCDEFGH
60 00 0A 41 42 43 44 45 46 47 48 90 00 F2 03

5.5.6. ICC Reader Microprocessor Card Raw T=1 Command Structure [46]

60 <length> 46 <NAD> <PCB> <LEN> <INF> <EDC> LRC 03

This command is used to pass a T=1 data block to a microprocessor card.

See Example T=1 Raw Read and Write Commands to Card page 45.

Response completed successfully 9000 is as follows:
60 00 02 90 00 F2 03

Possible response statuses:
2C04 no T=1 raw card seated
6906 reader configured without ICC support
9000 Success

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Example T=1 Raw Read and Write Commands to Card

This sample uses the IBM PC/SC T=1 Test Card (Card available from PC/SC workgroup).
Negotiate IFS (Propose maximum block size of 254 bytes).

60 00 06 46 00 C1 01 FE 3E LRC 03

Response

60 00 05 00 E1 01 FE 1E LRC 03

Select file 0007

60 00 0C 46 00 00 07 A4 A4 00 00 02 00 07 02 LRC 03

Response

60 00 14 00 00 10 63 0C 03 E8 00 07 00 00 00 FF FF 11 01 00 90 00 13 LRC 03

Write 1 byte to file at address 0000

60 00 0B 46 00 40 06 A4 D6 00 00 01 00 35 LRC 03

Response

60 00 06 00 40 02 90 00 D2 LRC 03

Read 1 byte from file starting at address 0000

60 00 0A 46 00 00 05 A4 B0 00 00 01 10 LRC 03

Response

60 00 07 00 00 03 00 90 00 93 LRC 03

Write 25 bytes to address 0000

60 00 23 46 00 40 1E A4 D6 00 00 19 **00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18** 2D LRC 03

Response

60 00 06 00 40 02 90 00 D2 LRC 03

Read 19H (25 decimal) bytes starting at address 0000

60 00 0A 46 00 00 05 A4 B0 00 00 19 08 LRC 03

Response

60 00 1F 00 00 1B **00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13 14 15 16 17 18** 90 00 93 LRC 03

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5.5.7. ISO 7816 Command Structure

CLA INS P1 P2 [Lc] [Data] [Le]

ISO 7816-3 Command Structure:

CLA INS P1 P2 P3 (Lc or Le) Data (if P3 is Lc)

Definition of Commands:

<CLA> ISO Class byte
<INS> ISO instruction code
<P1> ISO Parameter 1, usage varies with commands
<P2> ISO Parameter 2, usage varies with commands
<Lc> The number of bytes present in the data field of the command APDU
<Le> The maximum number of bytes expected in the data field of the response APDU.
<P3> ISO Parameter 3, length of data Lc or maximum length of expected reply Le
<Data> Data to send, varies with commands
<NAD> ISO Node Address always 0 for T=1 protocol
<PCB> ISO Protocol Control Byte for T=1 protocol
<LEN> Length byte for T=1 protocol
<INF> Information field for T=1 protocol
<EDC> Error detection code of the block, only LRC is supported.

Response Structure:
<Data>(Optional)<SW1> <SW2>

<Data> Response data usually Le bytes if operation was successful
<SW1> Status byte 1
<SW2> Status byte 2

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5.6. Memory Card Commands

5.6.1. General

The primary documentation detailing memory cards is the Spectrum III Memory Card Manual. Memory card commands consist of the memory command identifier (42H) and an ISO APDU. The reader interprets the command based on current selected memory card type and performs the requested operation. The reader returns ISO7816 status (SW1, SW2) after finishing the operation.

5.6.2. ICC Reader Memory Card Command Structure [42]

60 <length> 42 <Command> LRC 03

This command is used to perform an operation on a memory card.

For More information on accessing memory cards see SPT3 Memory Card Manual.
Response completed successfully 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

2A06 no ICC voltage defined on connector
2C03 no memory card seated
2D00 memory card type not supported
6904 reader configured without ICC support
6E00 memory card class must be 'DA'

5.6.3. Set Memory Card Type [53 12]

60 00 04 53 12 01 <Setting> LRC 03

<Setting> is a byte defined as follows.

Hex	Memory Card Description
00	**3-byte I^2C memory card**
01	4-byte I^2C memory card
02	SLE4428 and SLE4418 cards
03	SLE4442 and SLE4432 cards
06	SLE4404 and AT88SC101 cards

Example: Configure for a 4-byte I^2C memory card

60 00 04 53 12 01 01 25 03

Response is as follows:

60 00 02 <Return Status (2 bytes)> LRC 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

5.6.4. Set Memory Card Page Write Size [53 15]

60 00 0C 53 15 01 <Page Size in Bytes> LRC 03

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Page Size is a one byte value indicating the page size for the memory card. Only memory cards types zero and one use this feature. The default value of 8 will work for all supported cards. If performance of the write to card becomes a problem when writing larger blocks of data, setting this value correctly will increase performance.

Chip Type	Memory Card Type	Page Size	Card Size in Bytes
AT24C01A	0	8	128
AT24C02	0	8	256
AT24C04	0	16 (10H)	512
AT24C08	0	16 (10H)	1024
AT24C16	0	16 (10H)	2048
AT24C64	1	32 (20H)	8192
AT24C128	1	64 (40H)	16384
AT24C256	1	64 (40H)	32768
AT24C512	1	128 (80H)	65536

Command to set the page size to 32 bytes for the type 1 AT24C64 card.

60 00 04 53 15 01 20 03 03

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

5.7. SAM—Secure Access Module Support

5.7.1. SAM Purpose

SAM is a smart card in a smaller form factor, that provides authentication and or encryption support for a particular card type. They fit into either one SIM connector on the PCA or into up to five SIM connectors on an expansion board that attaches to the reader. If a reader is set up to support only one type of card then the reader will probably only need one SAM card. If a reader is configured to accept a variety of cards e.g. Visa, MasterCard and Discover (electronic purse/cash cards) it may need a SAM card for each card type that it supports.

5.7.2. Typical SAM Operation

Note: Because PC/SC v1.0 only can handle one card at a time, SAM access should be done without the PC/SC interface. This is necessary because when Windows Smart Card Manager talks to an ICC it controls the sequence numbering, chaining, etc. so it will become confused if attempting to talk to a second ICC before the session with the first ICC is closed.

In typical operation the host will ask the users card for a random number, which is then given to the SAM card. The SAM card will then generate an encoded message containing a secret key, which is presented to the user card. The user card will generate a response, which is given to the SAM card, which will then inform the host of the user's card validity.

Many types of smart card applications require additional security/fraud protection.

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One such method for insuring secure transactions is the use of a “Secure Application Module” (SAM). The SAM is a miniature smart card (it is slightly larger than the contact pads on a standard smart card) that contains security algorithms, and provides a secure place to store keys. ID TECH insert readers can optionally provide for up to five (5) independent SAM connectors, one is located on the main printed circuit board (PCA), or up to five are located on a separate PCA that is secured to the main PCA. The quantity required depends upon the customer’s application(s).

ID TECH’s family of EMV smart card and hybrid insert reader/writers can support up to 6 smart card connectors (5 SAM & 1 smart card connector). When addressing the connectors, the main (smart card) connector is assigned the number ‘0’, and each of the SAM modules is assigned a number from 1 to 5. If the SAM daughter board is used do not use the SAM connector on the main PCA because it is inaccessible and it has the same address as a connector on the SAM board so there would be a conflict.

5.7.3. ICC Connector Selection [43 0n]

60 00 02 43 <Card Connector> LRC 03

<Card Connector> is a byte defined as follows.

Hex	Connector Description
00	User Card Connector (main module)
01	SAM Connector 1 (on main board or on SAM daughter board)
02	SAM Connector 2
03	SAM Connector 3
04	SAM Connector 4
05	SAM Connector 5

The ICC Connector selection command allows the application to select a card (connector) to read from or to write to, the application can only communicate with one card at a time, either main user ICC or a SAM ICC. The user connector (0) is selected when the reader is powered or reset.

Command completed successfully response 9000 is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6905 reader not configured with SAM support or SAM connector > 5

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5.7.4. Set SAM Card Option [53 6n 02]

60 00 05 53 <SAM Setting> 0n <Card Option> [<Memory Card Type>] LRC 03

<SAM Setting> is a byte defined as follows.

Hex	
60	User Card Connector (Module 0) NEW
61	SAM Connector 1
62	SAM Connector 2
63	SAM Connector 3
64	SAM Connector 4
65	SAM Connector 5

<Card Option> and <Memory Card Type> are single bytes with the same definition as main card.

Note: SAM Connectors do not support 1.8 volt cards.

Example to set SAM connector 1 to an ISO, 5V, microprocessor card
60 00 05 53 61 01 10 LRC 03

Example to set SAM connector 3 to a 5V type 1 memory card (4 byte i2c).
60 00 05 53 63 02 80 01 LRC 03

Command completed successfully response 9000 is as follows:
60 00 02 90 00 F2 03

5.7.5. SAM Card Operation Scenario

a. Set “Card Option” and “Memory Card Type” for cards going to read/write on both main Module and SAM module (if necessary)
b. Select main card (optional)
c. Power on main card (optional)
d. Select SAM card
e. Power on SAM card
f. Select card connector (main or SAM)
g. Smart card (main or SAM) read/write operation
h. Repeat f and g until card access complete
i. Select SAM card (optional)
j. Power off SAM card (optional)
k. Select main card
l. Power off main card

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5.7.6. Notes for SAM Card Operation

"Get Reader Status" command reports the status of the user card only.

Power off the SAM card connectors before installing or removing any SAM cards. The easiest way to be sure of this condition is to disconnect power from the reader. The reader does not have a card seated signal for each SAM card and therefore is not able to power on or off these cards properly unless they start in a known state.

5.8. Return Status Summary and Explanation

Table 5 – Response Status Code Summary and Explanation

Code	Definition
C0xx	Magnetic Card Data with envelop
B00x	Card insert Notification
9000	Operation completed successfully (All Operations)
8C00	TCK error
8Bxx	Unsupported TAx, TBx, TCx, TDx
8900	ATR too long
880x	Power not ready for T=0 microprocessor card
8700	Protocol not supported by the reader
8600	Unsupported Fi or Di in PPS
8500	PPS confirmation error
8400	Parity error in reception
830x	Parity Error in transmission
8200	Unknown TS
810x	Time out
6E00	CLA not supported
6D0x	INS not supported
69xx	Command not supported
670x	Warning, Value read is different from value written
6688	Invalid PSC presented
6687	No more retries
6686	No more counter to decrease
2F00	ICC pulled from user slot while powered
2D0x	Memory card not supported
2C0x	Card not present
2B00	Address not supported
2A0x	Command received correctly, but could not complete
0080	Driver reported user supplied buffer too small
0079	Driver reported time out error

Note: See Appendix C for a full list of responses.

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6. HYBRID READER—MAGNETIC STRIPE SUPPORT

6.1. Features

ID TECH's magnetic stripe reader can be configured to read 1, 2, or 3 tracks of data from a card conforming to ISO 7811 standards. Its default setting reads and transmits data after a card withdrawal operation. This intelligent reader allows the user to control the magnetic stripe data as well as modify the interface parameters. This reader does not support data editing.

Interfaces	RS232 or USB 2.0 full speed
Max Tracks	Three each at 210 bpi
Formats Decoded	ISO-7811, California DMV format and AAMVA format

6.1.1. Message Format

Table 6 – Magnetic Stripe Message Formatting	
Terminator	**CR**, LF, CR/LF and None
Prefix	**None** Up to 9 characters
Track 1 ID	**None** One character
Track 2 ID	**None** One character
Track 3 ID	**None** One character
Suffix	**None** Up to 9 characters (after terminator)

6.1.2. Magnetic Stripe Data

MSR Reading	**Enable** and Disable
Decoding Method	Two Ways, Insertion, **Withdrawal**
Send Option	Start/End sentinel, Account Number only for 2nd Track
Track Selection	**Any Track**, T1, T2, T3, T1T2, T1T3, T2T3 and T1T2T3
Track Separator	Any ASCII Character
Track 1 ID	Any ASCII Character
Track 2 ID	Any ASCII Character
Track 3 ID	Any ASCII Character

6.2. Features Description

MSR Mode Setting

This feature allows the application program to enable or disable MSR reading and set MSR mode to auto transmit mode or buffered mode.

MSR Configuration Setting

This feature allows the application program to disable or enable the

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transmitting of the start/end sentinel, disable or enable Account Number only for second track.

Terminator/Prefix/Suffix

Reader supports simple message formatting by using the Terminator, the Prefix and the Suffix.

Track Selection

This feature allows the application program to specify which track(s) to read.

Track Separator

Track Separator can be any ASCII character, 00H is reserved for no separator.

Magnetic Standard Decode and Raw Data Decode

There are two MSR decode methods.

1. “Standard Decode” – follows ISO specification. This is the default method.

2. “Raw Data Decode” – With this feature, raw magnetic stripe data can be sent to the host for further processing. Two ASCII characters represent each raw data byte: the first ASCII character is for the high nibble of the hex code, and the second ASCII character is for the low nibble of the hex code. For example, the two characters “4” and “B” represent raw data 4Bh (01001011).

Configuring the reader to work in standard decode (default setting) or raw magnetic data decode is done with the 5.4.6 Set Operation Mode [53 11] command, page 36.

6.3. Default Card Data Output

SS1 T1_DATA ES CR
SS2 T2_DATA ES CR
SS3 T3_DATA ES CR

Where: SS1 (start sentinel track1) = ‘%’
SS2 (start sentinel track 2) = ‘;’
SS3 (start sentinel track 3) = ‘;’ for ISO, ‘!’ for CDL, ‘%’ for AAMVA

ES (end sentinel all tracks) = ‘?’

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6.4. Buffered Mode Operation Commands

6.4.1. Arm to Read Command [50 01 30]

60 00 03 50 01 30 02 03

This command enables the MSR to be ready for a card insert and withdrawal in buffered mode.

Any previously read data will be erased and reader will wait for the next insert and withdrawal.

As the user inserts and withdraws a card, the data will be saved, but will not be sent to the host. The reader holds the data until receiving the next “Arm to Read” or “MSR Reset” command.

A notification will be sent to inform host of magnetic data presence after a card is inserted and after it is withdrawn if the corresponding bit in “Operation Mode” has been set. See page 36.

Successful response is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6912 'P' command length must be 1
6916 'P' command data must be 0x30 or 0x32
6920 Reader not configured for buffered mode
6922 Reader not configured for magstripe read

6.4.2. MSR Reset Command [50 01 32]

60 00 03 50 01 32 00 03

This command will disable MSR read and clear any magnetic data in buffered mode. The reader enters to a disarmed state and will ignore MSR data.

Successful response is as follows:

60 00 02 90 00 F2 03

Other possible response statuses:

6912 'P' command length must be 1
6916 'P' command must be 0x30 or 0x32
6920 Reader not configured for buffered mode
6922 Reader not configured for magstripe read

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6.4.3. Read MSR Data Command [51 01]

60 00 03 51 01 <Track Selection Option> LRC 03

The <Track Select Option> byte is defined as follows:

ASCII	Hex	Track Selected
'0'	30	Any Track
'1'	31	Track 1
'2'	32	Track 2
'3'	33	Track 1 and Track 2
'4'	34	Track 3
'5'	35	Track 1 and Track 3
'6'	36	Track 2 and Track 3
'7'	37	Track 1, Track 2 and Track 3

This command requests card data information for the buffered mode.

The selected MSR data is sent to the host with or without envelope format, according to the operation mode setting.

This command does not erase the data.

Successful response is as follows:

60 00 02 <Len_H> <Len_L> <C0> <xx> <MSR Data> LRC 03

Other possible response statuses:

6911 'Q' command length must be 1
6921 reader not configured for buffered mode
C000 no magstripe data available

6.5. MSR Configuration Commands Description

All MSR reader Configuration Commands are listed in the following format:

60 <Length> 53 <FuncID> <Len> <FuncData> LRC 03

Length is a two bytes counter, which indicates length of data from 53 to end of <Func Data>. The most significant byte comes first.

Note: Default settings are in BOLD print

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6.5.1. MSR Transmit Mode Setting [53 1A]

60 00 04 53 1A 01 <MSR Transmit Mode> LRC 03
The <MSR Transmit Mode> byte is defined as follows:

ASCII	Hex	Definition
'0'	30	MSR Reading Disable
'1'	**31**	**MSR Reading Auto Transmit Mode**
'2'	32	MSR Reading in Buffered Mode **(Default if PC/SC mode)***

Example to enable MSR reading auto transmit mode
60 00 04 53 1A 01 31 1D 03
*Buffered mode is set automatically by the drivers on PC/SC readers and should not be changed.

6.5.2. MSR Read Direction Setting [53 1D]

60 00 04 53 1D 01 <Read Direction> LRC 03

The <Read Direction> byte is defined as follows:

ASCII	Hex	Definition
'1'	31	Read on both insertion and withdrawal
'2'	32	Read on insertion only
'3'	**33**	**Read on withdrawal only**

Example: 60 00 04 53 1D 01 33 18 03 read on withdrawal only

Note: Unless the users are trained or the reader is a partial insert reader about 20% of the population will not insert a card smoothly enough to be read during insertion. Nearly everyone extracts a card smoothly.

6.5.3. MSR Send Option Setting [53 19]

60 00 04 53 19 01 <Send Option> LRC 03

The <Send Option> byte is defined as follows.

Bit Position	'0'	'1'
0	No Start/End Sentinel	**Send Start/End Sentinel**
1	**All Data on track 2**	Account Number on track 2
2~7	Unused	

6.5.4. MSR Data Terminator Setting [53 21]

60 00 04 53 21 01 <Terminator Setting> LRC 03
The <Terminator Setting> byte is defined as follows:

ASCII	Hex	Definition
'0'	30	CR/LF
'1'	31	**CR**
'2'	32	LF
'3'	33	None

Example to set to send CRLF after the last MSR data
60 00 04 53 21 01 30 27 03

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6.5.5. MSR Data Prefix String Setting [53 D2]

60 <length> 53 D2 <Len> <Prefix String> LRC 03

Where:
<Prefix String> = {string length}{string}
{String length} is one byte, maximum value 9
<Len> is the number of bytes of Prefix string including string length
<length> is a two bytes counter, which indicates the number of bytes in command from 53 to the end of <Prefix String>. The most significant byte comes first.

Example to set the prefix to “TRK”
60 00 07 53 D2 04 03 54 52 4B AC 03

6.5.6. MSR Data Suffix String Setting [53 D3]

60 <length> 53 D3 <Len> <Suffix String> LRC 03

Where:
Suffix String = {string length}{string}
String length is one byte, maximum 9
Len is the number of bytes of Suffix string including string length
Length is a two bytes counter, which indicates the number of bytes in command from 53 to the end of the <Suffix String>. The most significant byte comes first.

Example to put a ‘]’ at the end of the MSR data
60 00 05 53 D3 02 01 5D BB 03

6.5.7. Track ID Setting [53 3n]

Track 1 ID Setting [53 31]

60 00 04 53 31 01 <Track 1 ID> LRC 03
<Track 1 ID>: ASCII code set as Track 1 ID, NULL for None.
Example: 60 00 04 53 31 01 00 07 03 Send no Track 1 ID

Track 2 ID Setting [53 32]

60 00 04 53 32 01 <Track 2 ID> LRC 03
<Track 2 ID>: ASCII code set as Track 2 ID, NULL for None.
Example: 60 00 04 53 32 01 32 36 03 Send Track 2 ID of ASCII ‘2’

Track 3 ID Setting [53 33]

60 00 04 53 33 01 <Track 3 ID> LRC 03
<Track 3 ID>: ASCII code set as Track 3 ID, NULL for None.
Example: 60 00 04 53 33 01 03 06 03 Send Track 3 ID of Hex 03

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6.5.8. Track Selection Setting [53 13]

60 00 04 53 13 01 <Track_Selection> LRC 03
<Track_Selection>:

ASCII	Hex	Definition
'0'	**30**	**Any Track**
'1'	31	Track 1 Only
'2'	32	Track 2 Only
'3'	33	Track 1 & Track 2
'4'	34	Track 3 Only
'5'	35	Track 1 & Track 3
'6'	36	Track 2 & Track 3
'7'	37	All Three Tracks

Example to select all 3 tracks and all must have data:
60 00 04 53 13 01 37 LRC 03

Note: If a track selected above (as opposed to any track), that track 'must' be present and good or the reader does not transmit any track information.

6.5.9. Track Separator Setting [53 17]

60 00 04 53 17 01 <Track_Separator> LRC 03

<Track_Separator> is one ASCII byte:
The default value is **CR** (Hex 0D).

Example to set the track separator to CR (carriage return)
60 00 04 53 17 01 0D 2C 03

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7. PC/SC APPLICATION PROGRAMMING IN C++

7.1. PC/SC Programming Overview

This manual does not attempt to document all possible smart card calls. Below are listed PC/SC functions to perform a simple transaction to a smart card in the order they are needed. The following link would be a typical link to get the full context of these smart card functions from the MSDN library.

http://msdn.microsoft.com/library/default.asp?url=/library/en-us/security/security/scardestablishcontext.asp

Also included are typical function calls that can be used to perform the various PC/SC functions. For programming functions that are vendor specific like magnetic stripe reading and latch see APPENDIX B: ID TECH PC/SC IDTLIB.DLL GUIDE page 86. For a sample program demonstrating the use of these functions, see Sample PC/SC VC++ Demonstration Program.

7.2. SCardEstablishContext

The **SCardEstablishContext** function opens a communication context with the resource manager context (the scope) within which database operations are performed.

SCardEstablishContext (SCARD_SCOPE_USER, NULL, NULL, &ContextHandle);

7.3. SCardConnect

The **SCardConnect** function establishes a connection (using a specific resource manager context) between the calling application and a smart card contained by a specific reader. If no card exists in the specified reader, an error is returned.

SCardConnect (ContextHandle, ReaderName [ReaderCount],
SCARD_SHARE_SHARED, SCARD_PROTOCOL_T0 |
SCARD_PROTOCOL_T1, &CardHandle, &ActiveProtocol);

7.4. SCardTransmit

The **SCardTransmit** function sends a service request to the smart card, and expects to receive data back from the card.

SCardTransmit (CardHandle, &IO_Request, scardSendBuff, sendLength, NULL,
scardRecvBuff, &recvLength);

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7.5. SCardDisconnect

The **SCardDisconnect** function terminates a connection previously opened between the calling application and a smart card in the reader.

SCardDisconnect (CardHandle, SCARD_EJECT_CARD);

7.6. SCardReleaseContext

The **SCardReleaseContext** function closes an established resource manager context, freeing any resources allocated under that context, including SCARDHANDLE objects and memory allocated using the SCARD_AUTOALLOCATE length designator.

SCardReleaseContext (ContextHandle);

SCardReleaseContext (ContextHandle);

Table 7 – SCARD Error to Value

Error Code	Hexadecimal Value
SCARD_F_INTERNAL_ERROR	80100001
SCARD_E_CANCELLED	80100002
SCARD_E_INVALID_HANDLE	80100003
SCARD_E_INVALID_PARAMETER	80100004
SCARD_E_INVALID_TARGET	80100005
SCARD_E_NO_MEMORY	80100006
SCARD_F_WAITED_TOO_LONG	80100007
SCARD_E_INSUFFICIENT_BUFFER	80100008
SCARD_E_UNKNOWN_READER	80100009
SCARD_E_TIMEOUT	8010000A
SCARD_E_SHARING_VIOLATION	8010000B
SCARD_E_NO_SMARTCARD	8010000C
SCARD_E_UNKNOWN_CARD	8010000D
SCARD_E_CANT_DISPOSE	8010000E
SCARD_E_PROTO_MISMATCH	8010000F
SCARD_E_NOT_READY	80100010
SCARD_E_INVALID_VALUE	80100011
SCARD_E_SYSTEM_CANCELLED	80100012
SCARD_F_COMM_ERROR	80100013
SCARD_F_UNKNOWN_ERROR	80100014
SCARD_E_INVALID_ATR	80100015
SCARD_E_NOT_TRANSACTED	80100016
SCARD_E_READER_UNAVAILABLE	80100017

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Table 7 – SCARD Error to Value	
Error Code	Hexadecimal Value
SCARD_P_SHUTDOWN	80100018
SCARD_E_PCI_TOO_SMALL	80100019
SCARD_E_READER_UNSUPPORTED	8010001A
SCARD_E_DUPLICATE_READER	8010001B
SCARD_E_CARD_UNSUPPORTED	8010001C
SCARD_E_NO_SERVICE	8010001D
SCARD_E_SERVICE_STOPPED	8010001E
SCARD_E_UNEXPECTED	8010001F
SCARD_E_ICC_INSTALLATION	80100020
SCARD_E_ICC_CREATEORDER	80100021
SCARD_E_UNSUPPORTED_FEATURE	80100022
SCARD_E_DIR_NOT_FOUND	80100023
SCARD_E_FILE_NOT_FOUND	80100024
SCARD_E_NO_DIR	80100025
SCARD_E_NO_FILE	80100026
SCARD_E_NO_ACCESS	80100027
SCARD_E_WRITE_TOO_MANY	80100028
SCARD_E_BAD_SEEK	80100029
SCARD_E_INVALID_CHV	8010002A
SCARD_E_UNKNOWN_RES_MNG	8010002B
SCARD_E_NO_SUCH_CERTIFICATE	8010002C
SCARD_E_CERTIFICATE_UNAVAILABLE	8010002D
SCARD_E_NO_READERS_AVAILABLE	8010002E
SCARD_E_COMM_DATA_LOST	8010002F
SCARD_W_UNSUPPORTED_CARD	80100065
SCARD_W_UNRESPONSIVE_CARD	80100066
SCARD_W_UNPOWERED_CARD	80100067
SCARD_W_RESET_CARD	80100068
SCARD_W_REMOVED_CARD	80100069
SCARD_W_SECURITY_VIOLATION	8010006A
SCARD_W_WRONG_CHV	8010006B
SCARD_W_CHV_BLOCKED	8010006C
SCARD_W_EOF	8010006D
SCARD_W_CANCELLED_BY_USER	8010006E

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Table 8 – SCARD Error Text Description	
	Text Description
SCARD_E_BAD_SEEK	An error occurred in setting the smart card file object pointer.
SCARD_E_CANCELLED	A SCardCancel request canceled the action.
SCARD_E_CANT_DISPOSE	The system could not dispose of the media in the requested manner.
SCARD_E_CARD_UNSUPPORTED	The smart card does not meet minimal requirements for support.
SCARD_E_CERTIFICATE_UNAVAILABLE	The requested certificate could not be obtained.
SCARD_E_COMM_DATA_LOST	A communications error with the smart card has been detected.
SCARD_E_DIR_NOT_FOUND	The specified directory does not exist in the smart card.
SCARD_E_DUPLICATE_READER	The reader driver didn't produce a unique reader name.
SCARD_E_FILE_NOT_FOUND	The specified file does not exist in the smart card.
SCARD_E_ICC_CREATEORDER	The requested order of object creation is not supported.
SCARD_E_ICC_INSTALLATION	No primary provider can be found for the smart card.
SCARD_E_INSUFFICIENT_BUFFER	The data buffer for returned data is too small for the returned data.
SCARD_E_INVALID_ATR	An ATR string obtained from the registry is not a valid ATR string.
SCARD_E_INVALID_CHV	The supplied PIN is incorrect.
SCARD_E_INVALID_HANDLE	The supplied handle was invalid.
SCARD_E_INVALID_PARAMETER	One or more of the supplied parameters could not be properly interpreted.
SCARD_E_INVALID_TARGET	Registry startup information is missing or invalid.
SCARD_E_INVALID_VALUE	One or more of the supplied parameter values could not be properly interpreted.
SCARD_E_NO_ACCESS	Access is denied to the file.
SCARD_E_NO_DIR	The supplied path does not represent a smart card directory.
SCARD_E_NO_FILE	The supplied path does not represent a smart card file.
SCARD_E_NO_MEMORY	Not enough memory available to complete this command.
SCARD_E_NO_READERS_AVAILABLE	No smart card reader is available.

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Table 8 – SCARD Error Text Description	
	Text Description
SCARD_E_NO_SERVICE	The smart card resource manager is not running.
SCARD_E_NO_SMARTCARD	The operation requires a smart card but no smart card is currently in the device.
SCARD_E_NO_SUCH_CERTIFICATE	The requested certificate does not exist.
SCARD_E_NOT_READY	The reader or card is not ready to accept commands.
SCARD_E_NOT_TRANSACTED	An attempt was made to end a non-existent transaction.
SCARD_E_PCI_TOO_SMALL	The PCI receive buffer was too small.
SCARD_E_PROTO_MISMATCH	The requested protocols are incompatible with the protocol currently in use with the card.
SCARD_E_READER_UNAVAILABLE	The specified reader is not currently available for use.
SCARD_E_READER_UNSUPPORTED	The reader driver does not meet minimal requirements for support.
SCARD_E_SERVICE_STOPPED	The smart card resource manager has shut down.
SCARD_E_SHARING_VIOLATION	The smart card cannot be accessed because of other outstanding connections.
SCARD_E_SYSTEM_CANCELLED	The action was canceled by the system, presumably to log off or shut down.
SCARD_E_TIMEOUT	The user-specified timeout value has expired.
SCARD_E_UNEXPECTED	An unexpected card error has occurred.
SCARD_E_UNKNOWN_CARD	The specified smart card name is not recognized.
SCARD_E_UNKNOWN_READER	The specified reader name is not recognized, reader maybe disconnected.
SCARD_E_UNKNOWN_RES_MNG	An unrecognized error code was returned from a layered component.
SCARD_E_UNSUPPORTED_FEATURE	This smart card does not support the requested feature.
SCARD_E_WRITE_TOO_MANY	An attempt was made to write more data than would fit in the target object.
SCARD_F_COMM_ERROR	An internal communications error has been detected.
SCARD_F_INTERNAL_ERROR	An internal consistency check failed.
SCARD_F_UNKNOWN_ERROR	An internal error has been detected, but the source is unknown.
SCARD_F_WAITED_TOO_LONG	An internal consistency timer has expired.

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Table 8 – SCARD Error Text Description	
	Text Description
SCARD_P_SHUTDOWN	The operation has been aborted to allow the server application to exit.
SCARD_S_SUCCESS	No error was encountered.
SCARD_W_CANCELLED_BY_USER	The action was cancelled by the user.
SCARD_W_CHV_BLOCKED	The card cannot be accessed because the maximum number of PIN entry attempts has been reached.
SCARD_W_EOF	The end of the smart card file has been reached.
SCARD_W_REMOVED_CARD	The smart card has been removed, so further communication is not possible.
SCARD_W_RESET_CARD	The smart card has been reset, so any shared state information is invalid.
SCARD_W_SECURITY_VIOLATION	Access was denied because of a security violation.
SCARD_W_UNPOWERED_CARD	Power has been removed from the smart card, so further communication is not possible.
SCARD_W_UNRESPONSIVE_CARD	The smart card is not responding to a reset.
SCARD_W_UNSUPPORTED_CARD	The reader cannot communicate with the card, due to ATR string configuration conflicts.
SCARD_W_WRONG_CHV	The wrong PIN was presented preventing card access.

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8. HYBRID READER DEMONSTRATION SOFTWARE

There are three demonstration programs for the SPT3. Use the HRDLL Demo for a reader not operated in PC/SC mode. The other two programs demonstrate PC/SC reader access in C++ and VB. The PC/SC Visual C++ Demonstration Program and the PC/SC Visual Basic Demo Program SP2-SPT3 PCSC VB DEMO. These programs demonstrate how the reader functions and provide sample code to develop an application to integrate the Spectrum 3 into a system.

8.1. HRDLL Demo Program Non-PC/SC

HRDLL is a software program that allows the user to perform simple read operations with both smart and magnetic cards, and write to the smart card. This program is described in detail in the document included in the CD \manuals\ HrDLL_Dynamic_Link_Library_454.pdf.

8.2. PC/SC Visual C++ Demonstration Program

This PC/SC demonstration and sample program was written in Microsoft Visual C++ 6.0. The demonstration program is only meant to run when there is a PC/SC smart card reader attached to the system. The program responds differently if the ID TECH Hybrid Reader is connected and selected than if another manufacturer's PC/SC reader is selected. The purpose of this program is to demonstrate how to find, connect to and use ID TECH PC/SC hybrid reader in a Windows environment.

This demonstration program on start up reacts differently if there is more than one PC/SC reader found attached to the system than if there is only one reader attached to the system. Buttons are grayed out when a function is not available. The demo program is configured to support a maximum of four connected PC/SC smart card readers; any beyond this limit are not displayed.

For any function that accesses the reader (except test hardware) the first operation that must be done is to connect either to the reader or to the card. Do this by selecting the "Connect to Rdr" or "Connect to Card" button. If a microprocessor card is seated in the reader and will remain in the reader until the smart card access portion of the connection is done then the user should select connect to card. If smart card accesses are going to be made then the user should connect to the card. For all other function connect to the reader. If it is desired to connect to the card when connected to the reader or vice versa, select the "Disconnect" button and then the appropriate button.

If the reader is not an ID TECH reader then the demo program does not give the option of connecting to the reader, because the reader's PC/SC driver does not support this vendor specific function.

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8.2.1. Requirement

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC that has installed an ID TECH PC/SC driver. You also need the ID TECH Standard microprocessor Smart Card to perform the operation.

This demo program requires the use of idtlib.dll ID TECH's PC/SC hybrid reader support DLL. An application can be written to do all reader function without this DLL, but the use of the DLL simplifies the use of the reader functions. The software supports readers in PC/SC mode.

8.2.2. Installation

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC and install the PC/SC driver. If not already done, see 3.3.1 Install PC/SC Driver page 14 for instructions. You also need the ID TECH standard microprocessor Smart Card to perform the operation. The software supports up to four PC/SC readers.

Install this program by double clicking on setup.exe in the installation CD in the \Demo\SPT3CppPcscDemo v2.0.1.0 directory and follow the directions. The program can be run without installation by opening the release directory and running SPT3CppPcscDemo.exe from that directory. The program is composed of two parts, IDT PCSC Demo.exe and IDTLIB.DLL.

8.2.3. Operation

Timeout

The "Set Magstripe Timeout" and "Get Magstripe Timeout" buttons are the buttons to set the timeout functions for how long the reader/driver should wait for an expected event before aborting. The default timeout is 30 seconds. To change the default timeout type a decimal number between 0 and 255 seconds into the command field then select the "Set Magstripe Timeout" button. To check the current value of the timeout, select the "Get Magstripe Timeout" button.

Version

The get version command button in upper right hand corner returns the "Reader Version", "DLL Version" and "Driver Version" will be returned in the message window. The Demo version can be displayed by right clicking on the title bar and then selecting about SPT3Demo.

Latch

Use the "Latch On" and "Latch Off" commands to latch a card in the reader to keep it from being extracted while the ICC is being accessed. Pulling the card during this period is called tear. The latch can only close when there is a card seated in the reader. It is possible, but more difficult to pull a card out of the reader while it is held by the latch.

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Send Command

The “Send Command” button is to send user commands through the PC/SC driver to the reader. Use this command to issue commands to the reader or card as if it was not in PC/SC mode. For instance to get the readers version enter ‘39’ in the message field and select the send command button. Another example to get the readers status, enter a ’24’ in the message field and select the command button.

Send APDU

The “Send APDU” button sends a particular APDU to a microprocessor (asynchronous) card. APDUs are always at least 4 bytes and usually at least 5 bytes. An example of an APDU for the Sample T=0 smart card provided by ID TECH is to type 00 A4 00 00 02 31 40 in the message field then select the send APDU button. This is the command to select file 3140, this file can be accessed without a password. To read the first 4 bytes of the content of that file enter 90 52 00 00 04 in the message field then select the send APDU button. The response should look like 00 06 90 48 F5 00 90 00. The 90 00 at the end of a smart card response is the normal response code for success.

Magnetic Stripe

The “Get Magstripe Data” button powers the card off and if a magnetic stripe card is withdrawn before the time out period it will display the magnetic stripe data in the response window. If the reader remains at its default configuration then the tracks of data will be displayed on separate lines with track 1 first and track 3 last. If one desires to get a specific track or tracks the numbers 0-7 can be entered in the command box and the reader will return the requested tracks. It is better to select 0 get any track if that is acceptable rather than 7, which is, get all three tracks, because the reader will not send the track data unless all three tracks are error free.

Test Hardware

The “Test Hardware” button function is designed to use a Sample ID TECH T=0 test card and verify that the reader card communication, seated switch, latch, smart card access, and magnetic stripe access are functional. If the reader passes this test it is functioning properly.

Set LED

The “Set LED” button function is designed to change the LED setting on the reader. Note: the reader must be changed from the default “reader controlled LED” to host controlled LED”. To do this enter 53 11 01 3F in the command box and then select the send Command button. Note: this command assumes that the reader is at the default setting. Once the reader is configured to accept LED commands, enter the number of the LED command 30 through 37 then select the set LED button. The LED should now display with the desired appearance.

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Configuration

The “Read Configuration”, “Configure for EMV Card”, and “Configure for ISO7816” buttons are a group. EMV is somewhat tighter specification than ISO7816. PC/SC configures the reader to support this specification. All cards should be able to connect with the reader set to ISO7816 as this is a more general specification, but not all communication will function properly if the reader is to be used in an EMV environment.

Card Off

The “Card Off” button powers down the current card in the reader.

Get Status Direct

The get status direct function is occasionally necessary if one needs to determine the full current status of the reader on functions for which notifications are not being sent for instance is the card in the reader currently latched? This function should not normally be used to get the readers status because the performance of the PC would be slowed by the extra commands being sent to the reader when the driver already knows the readers status.

Exit

The “Exit” button closes the demo program and release the reader to allow it to be attached by another application.

There are four card states UNKNOWN, UNSEATED, SEATED and POWERED and there are four connection states UNKNOWN, DISCONNECT, TOCARD and TOREADER.

8.2.4. Program Source Code:

This Demonstration program is provided with Source code (compiled with MS Visual C++ 6.0) to aid the developer in quickly making an application that properly performs the intended functions through the PC/SC interface and utilizing the supplied DLL.

8.3. PC/SC Visual Basic Demonstration Program

ID TECH has developed a PC/SC VB Demo Program named “ID TECH PC/SC VB Demo”.

8.3.1. Requirement

To test this program, you must connect the ID TECH PC/SC reader to a Windows 2000 or a Windows XP PC that has installed the ID TECH PC/SC driver. You also need the ID TECH standard microprocessor smart card to perform the operation. The software supports multiple readers, but all readers must be in PC/SC mode.

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8.3.2. Installation

Installation can be accomplished by clicking on the setup.exe program on the installation CD and following the directions prompted by the windows. The program can be run without installation by selecting the support directory then running IdtPcscVbDemo.exe.

8.3.3. Launching

Before launching the program, make sure that the ID TECH PC/SC Reader is connected to the PC and the ID TECH standard microprocessor card is seated in the reader. Select “Start – Programs – IDT PCSC VB Demo” to launch the program. If the program reports Smart card resource manager not running then see 11.4 on page 85.

The program should automatically detect the connected ID TECH PC/SC Reader. If there is more that one smart card reader connected to the PC then select “ITS 0030 0” reader from the list of smart card readers in use.

8.3.4. Operation

In the program GUI, there are three groups of command buttons. Each group performs different function test.

In “ID TECH CPU Card” group, if you press the “Read” button, the program reads 15 characters from the smart card. Pressing the “Write” button allows you to write a string to the card.

In “General CPU Card” group, first press “Connect to Card” to establish the connection to the card. Then type in an APDU command in the APDU test box and press “Send T=0 APDU” button. The data should be in ASCII format and nonprintable characters should be represented by \XX. For example, “\00\D6\00\00\07ID TECH” is a correct APDU. (A sample APDU shows up when you put the cursor in the “APDU String” box but do not click the mouse). You may repeat this step to perform all the operation that you want and press “Disconnect” to finish the operation.

You may need to write down all the APDU commands in paper, check it very carefully then type in these commands. Improper commands might permanently damage the test card!

The “Special Commands” group allows you to perform Latch and MSR function and to get the reader, driver and DLL version. You need to connect to the card or reader by clicking the “Connect to Reader” button or “Connect to Card” button before you can do the rest of the operation. After finishing all operations, you need to press “Disconnect” button in “General CPU Card” group to disconnect.

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Pressing the “Latch On” button locks the latch in the reader. You should hear the “click” sound and the card should be locked in the reader. Pressing the “Latch Off” button unlocks the latch in the reader. You should hear another “click” sound and the card should be able to be pulled out. Only the standard chassis supports the latch and its function.

Pressing the “Read Version” button displays the PC/SC driver version number, the IdtDll.dll (please see “Program Source Code” section for description) version number and the PC/SC reader version number.

To read a magnetic stripe card, click connect to reader, then insert the magnetic stripe card in the reader, then click the “Read MSR” button and properly withdraw the card within a “MSR Timeout” period. If success, the magnetic stripe data should be displayed in the “Response” text box. Each time after you boot up your PC, the “MSR Timeout” is set to the default value of 30 seconds. Use the “MSR Timeout” button to change the PC/SC driver MSR timeout delay.

8.3.5. Program Source Code

The “ID TECH PC/SC VB Demo” program is provided with source code to help the user developing their application program. The code is written in Microsoft Visual Basic 6. Following is a list of files

IdtPcscDemo.frm – The main project form

PcscInterface.bas – A utility module to declare the Windows Smart Card API. The variable names, such as those in typedef's and function parameters, have been retained from the C++ API definition.

PscsError.bas – A utility module to define error codes in Windows Smart Card API

IdtLib.dll – A utility dynamic linked library to provide support for ID TECH PC/SC reader special function, such as Latch Function, MSR function…

IdtLib.bas – A utility module to declare functions in the IdtLib.dll

IdtPcscVbDemo.vbp – The project file

User may develop their application program by modifying the main project form. All the utility modules and DLL can be included in their project without or with very little modification.

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9. SPECIFICATIONS

Table 9 – Electrical Specifications

RS232 or PC/SC:	+5 VDC/80mA* (power adapter regulated 5 VDC/500mA or equivalent).
USB:	Power supplied by the host computer.
Operating Current:	80mA maximum for three tracks of magnetic data.
Chassis Ground:	Connected to GND and magnetic head case.

*Without latch or smart card option(s).

Table 10 – Environmental Specifications

Operating Temperature:[4]	32° F to 131° F (0° C to 55° C).
Storage Temperature:	-40° F to 158° F (-40° C to 70° C).
Humidity:	Maximum 95% non-condensing.

Table 11 – Reliability Specifications

Magnetic Head Life:	1,000,000 passes minimum.*
IC Card Connector:	1,000,000 cycles minimum.* Contacts are gold plated and exceed EMV life requirements for minimum resistance over the life of the reader.
Chassis and Bezel:	1,000,000 card cycles minimum.*

*All wear reliability numbers are based on operation in a benign environment.

[4] Extended temperature available

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Table 12 – Mechanical Specifications

Magnetic Stripe Formats:	ISO 7811, F2F. Media with magnetic coercivity of 300 through 4,000 Oersted can be read.
Smart Card Contacts	ISO 7816-2 Smart Cards, Reader meets EMV contact force and resistance specifications. Contacts are Landing Contacts.
Reading Speed:	5 to 60 inches per second.
Media Thickness:	.025 to .035 inches. Maximum card thickness .035 inches.
Dimensions:	See the outline drawings in the following section for dimensions on the standard and compact chassis. The bezel type, size, and panel cutouts are also given in drawing format.
Options: Standard Chassis	Latch, Gate, Security Access Module (SAM) , LED Indicator, “Card Seated” Signal (optional for magnetic stripe, standard for ICC), “Card Present” Signal, Metal Bezel (other bezels are mounted to the reader chassis; the metal bezel not mounted and is supplied separate.
Options: Compact Chassis	Security Access Module (SAM) , LED Indicator, “Card Seated” Signal (optional for magnetic stripe, standard for ICC), “Card Present” Signal

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10. HARDWARE DIMENSIONS, MOUNTING AND CONNECTORS

10.1. Dimensions of Spectrum III

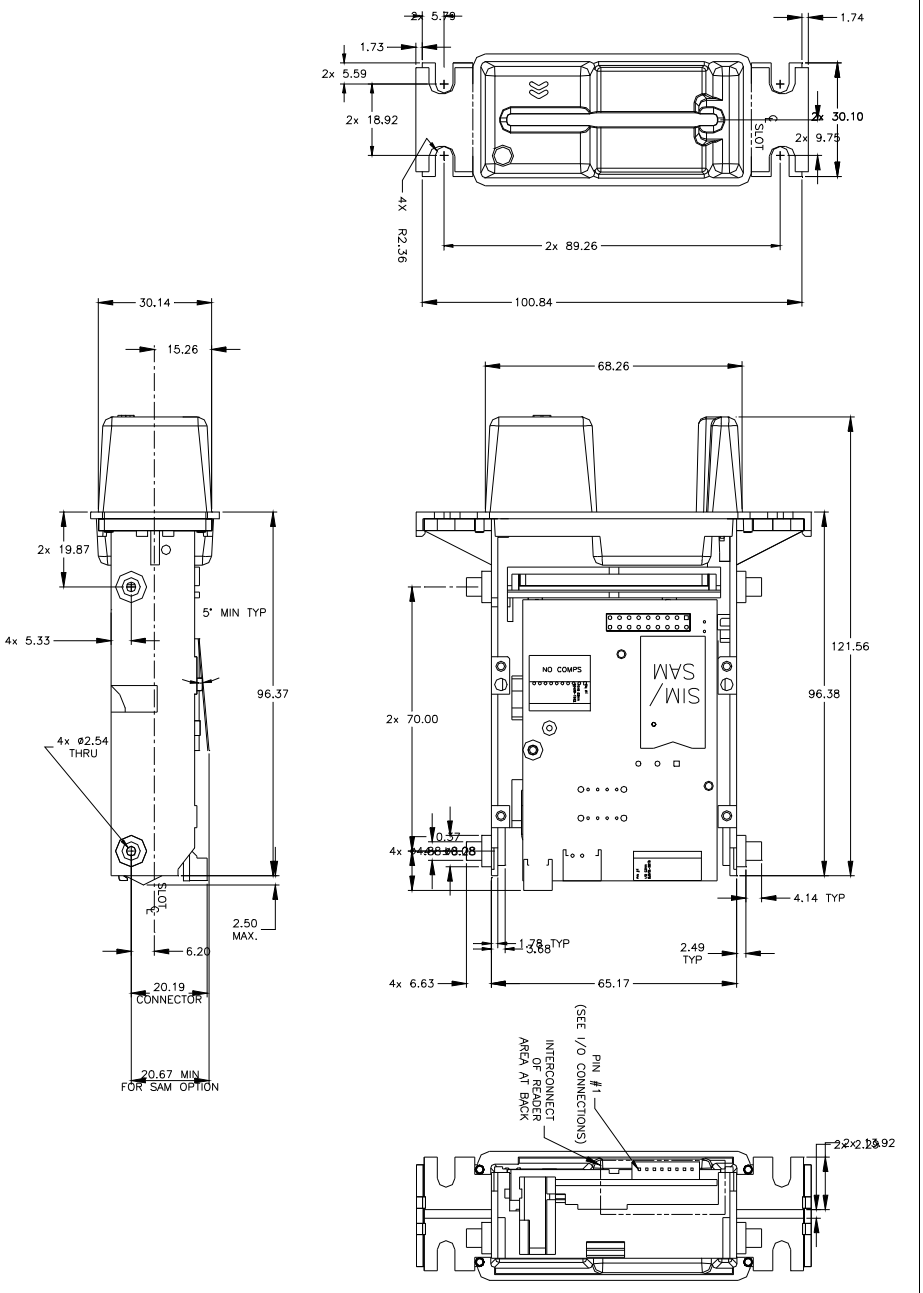

Figure 3 – Spectrum III Dimensions

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10.2. Dimension of Spectrum III with SAM daughter board

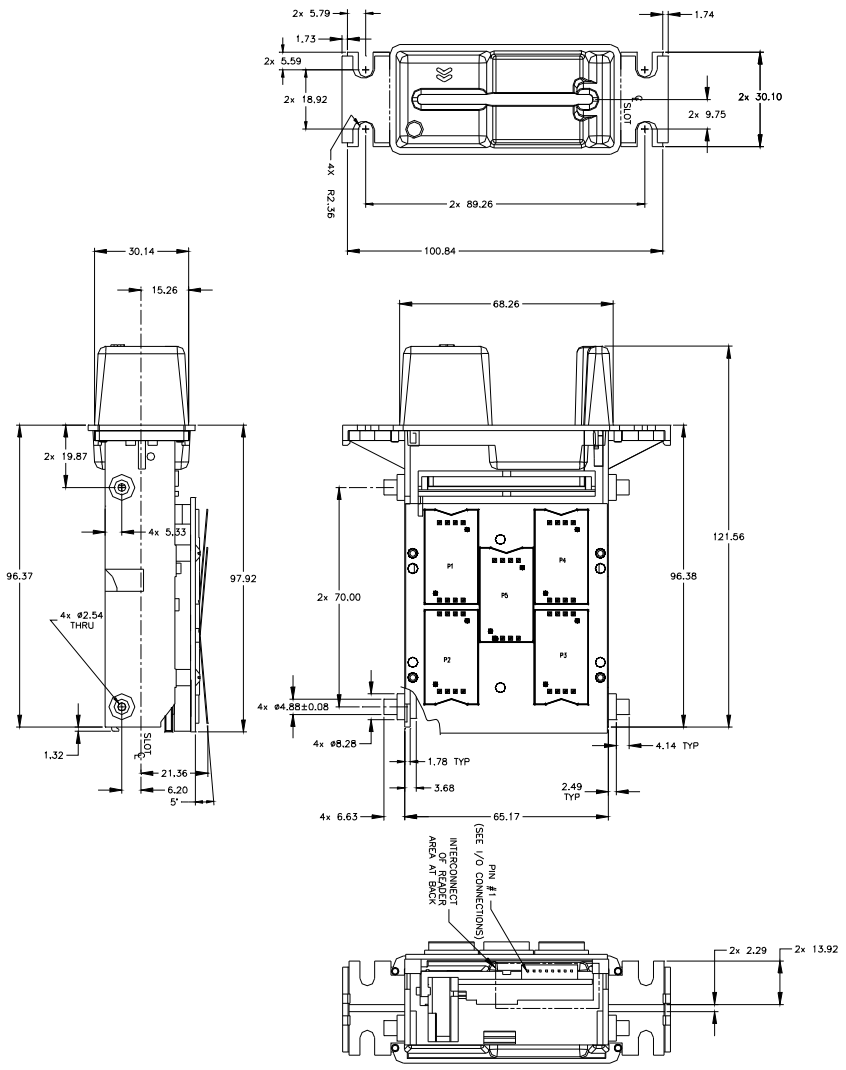

Figure 4 – Spectrum III Dimensions With SAM Daughter Board

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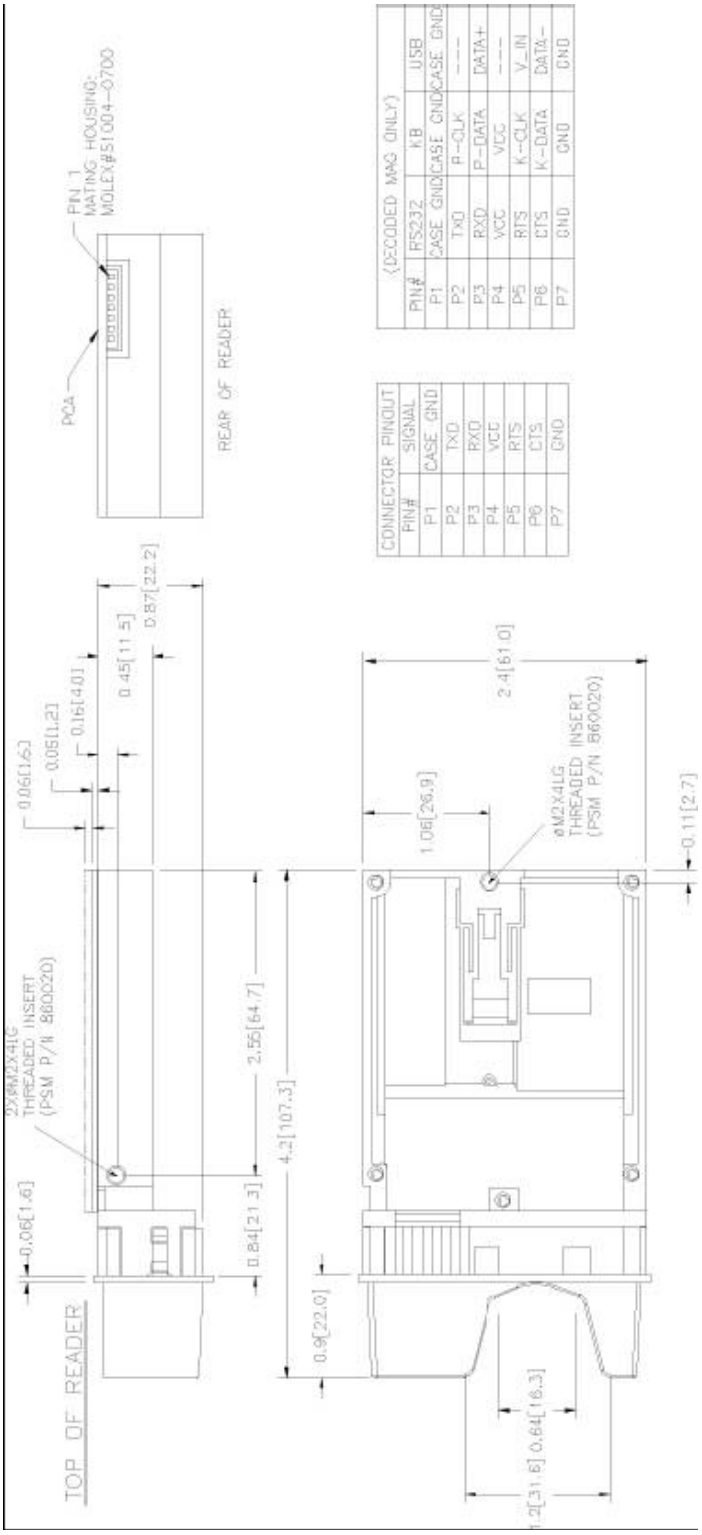
10.3. Dimension of Spectrum III Compact chassis with its bezel



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10.4. Mounting

The standard chassis is mounted using the front flange or the side mounting studs. The compact chassis is mounted using the side threaded inserts; the rear, bottom threaded insert can also be used.

The reader should be mounted with the debris slot facing down.

10.5. Hybrid Reader Connectors

The connection to the insert reader is provided through a 7 or 8-pin header at the rear of the chassis. On RS232 units power is 5 Volts DC and supplied through pin four (4) on the header, on the insert reader's PCA. ID TECH has optional cables for mating the 7 or 8-pin connector on one end, and a standard USB or DB9 female connector with receptacle for a Power Jack on the opposite end. The DB9 connector has standard RS232 pin outs (see below) and connects to host's RS232 Port.

There is a connector for the optional power failure latch release capacitor. This capacitor (P/N 80059215-001) is needed only if the main power supply does not have reserve output capacity in the event of a power line failure.

The following sub-sections define reader connector signals and pin-out.

Pin Designation for the 7 Pin Header on the USB Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CH_GND
PIN 2:	---
PIN 3:	D+
PIN 4:	---
PIN 5:	V_IN
PIN 6:	D-
PIN 7:	GND

Header Description: Molex P/N: 51004-0700

DB9 Female Host Connector Pin Designation

RS232 DB9 Connector	
Position	Signal Name
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	DSR
PIN 5:	GND
PIN 6:	DTR
PIN 7:	CTS
PIN 8:	RTS

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Pin Designation for the 8 Pin Header on the RS232 Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CASE GND
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	VCC/DTR
PIN 5:	RTS
PIN 6:	CTS
PIN 7:	GND
PIN 8:	DSR

Header Description: Molex P/N: 51004-0800

Pin Designation for the 7 Pin Header on the RS232 Insert Reader

Molex Connector	
Position	Signal Name
PIN 1:	CASE GND
PIN 2:	TXD
PIN 3:	RXD
PIN 4:	VCC/DTR
PIN 5:	RTS
PIN 6:	CTS
PIN 7:	GND

Header Description: Molex P/N: 51004-0700

Power Adapter (RS232 Units only)

5V, 500mA

Polarity: Center Positive (+)

Warning: Any power supply (VCC) higher than 5.5 V may damage the unit

Note: There is a 12V option PCA for the reader; it can not be used with the SAM daughter board because they both mount in the same location.

10.6. Hybrid Reader Bezel information

There are three available bezels shown in the drawings below. Select the desired bezel type for cutout and mounting. Other bezel option may be available; contact the nearest Sales Representative for information.

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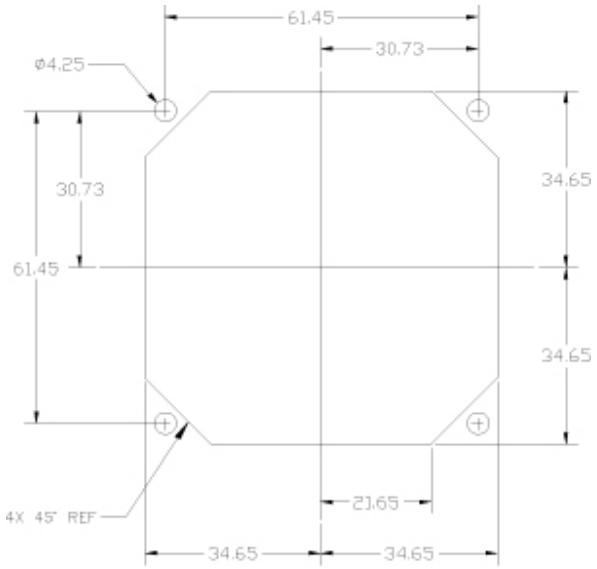

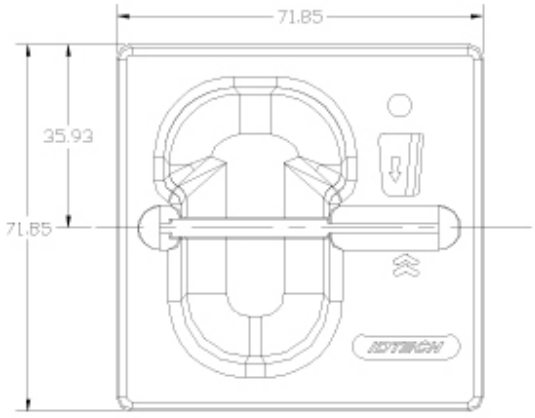

FLUSH BEZEL
CUTOUT & FRONT VIEW

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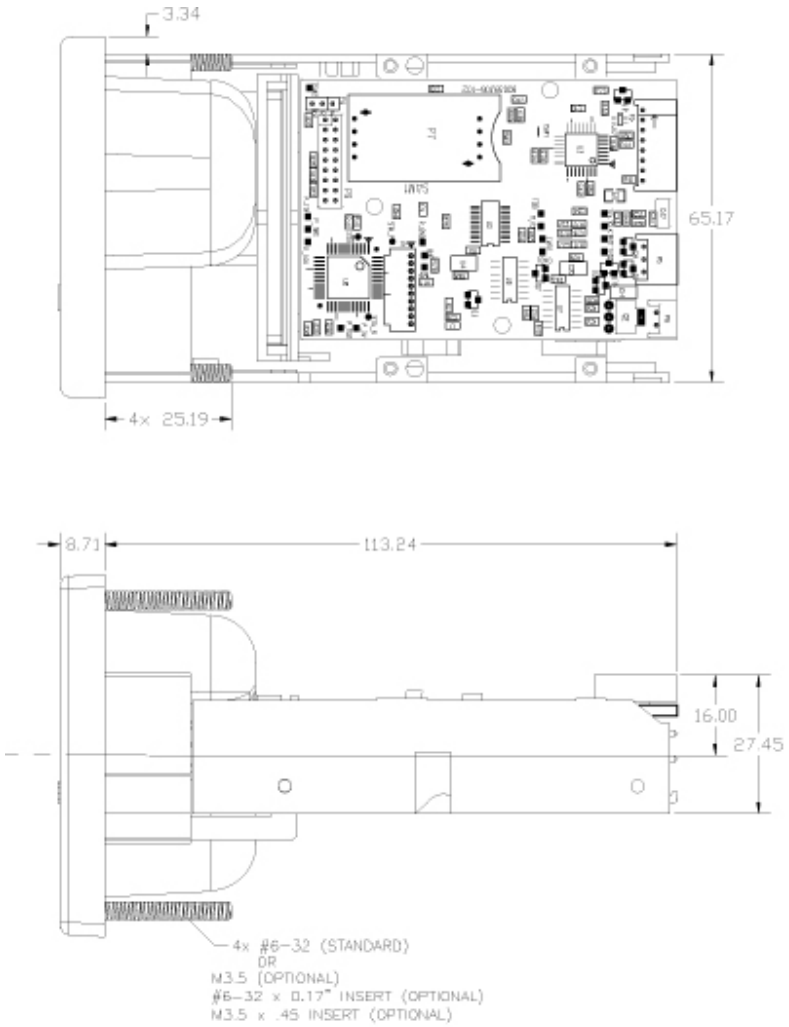

FLUSH BEZEL
MOUNTED, TOP & SIDE VIEW

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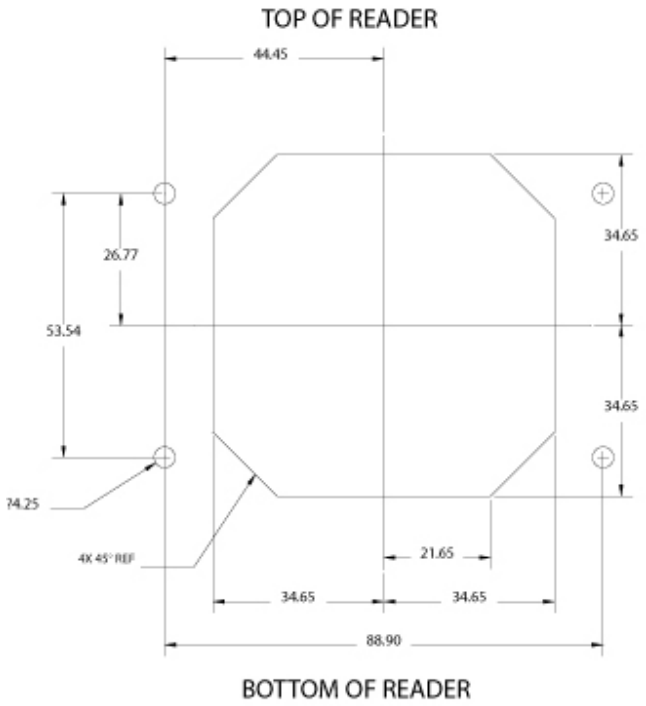

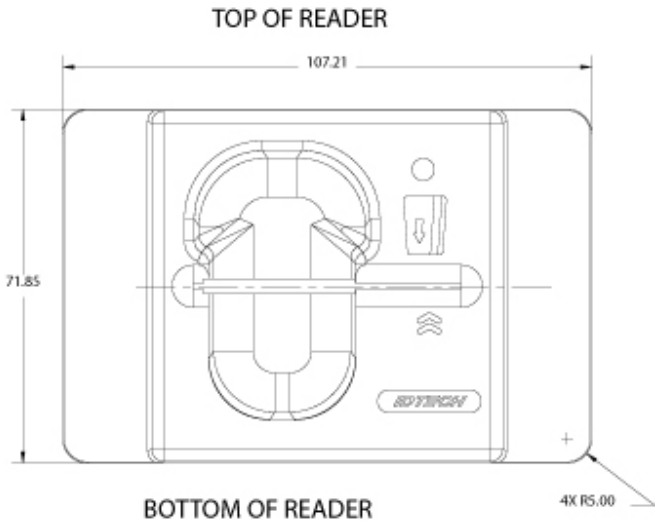

LARGE FLUSH BEZEL

CUTOUT & FRONT VIEW

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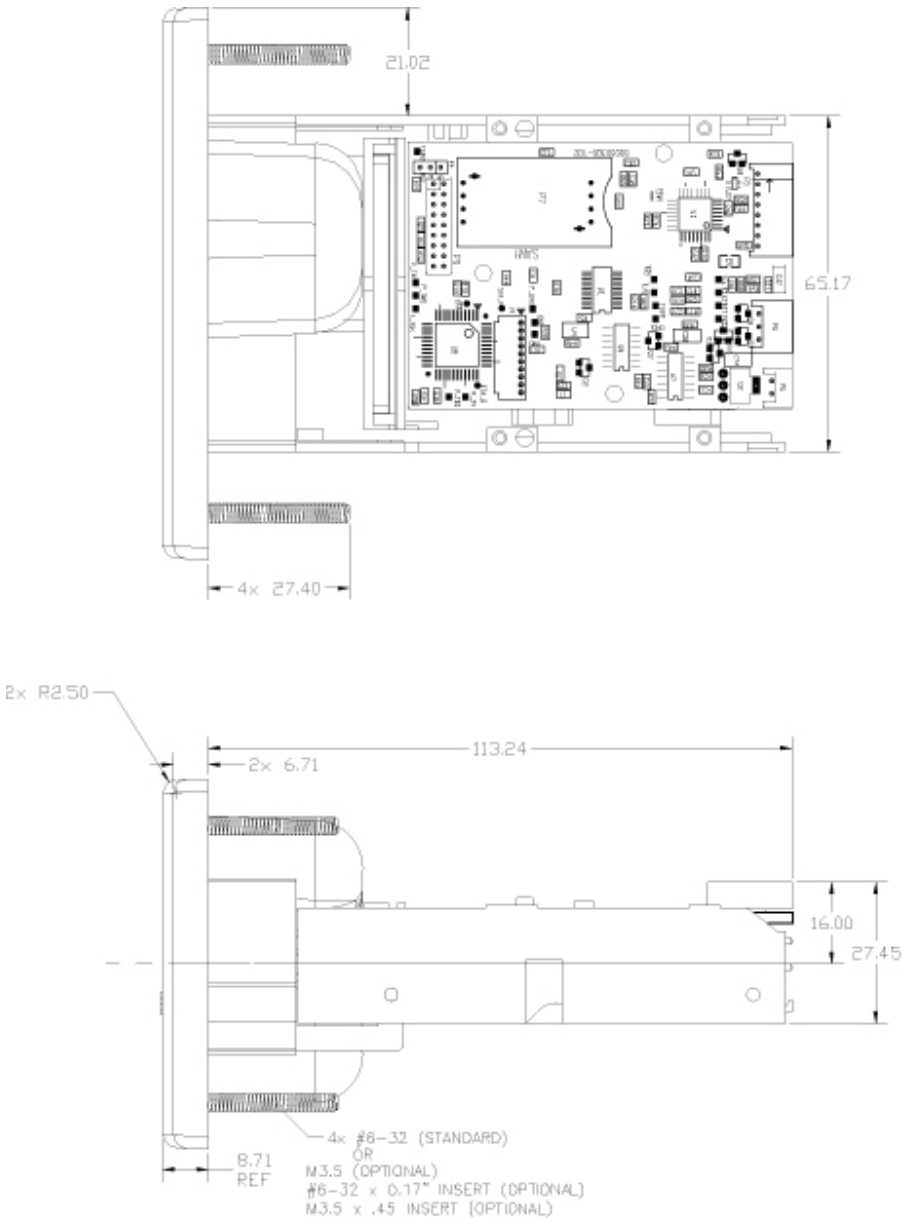

LARGE FLUSH BEZEL
MOUNTED, TOP & SIDE VIEW

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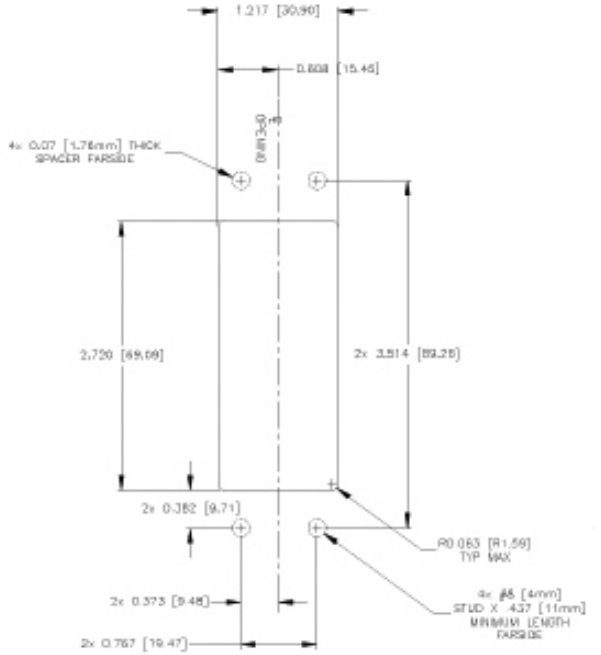

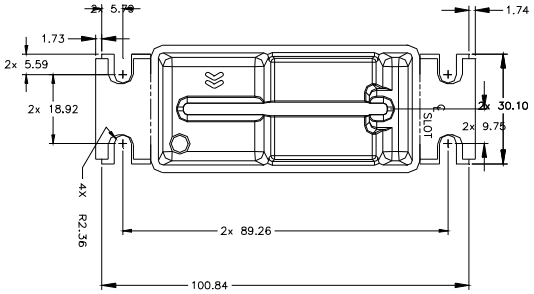

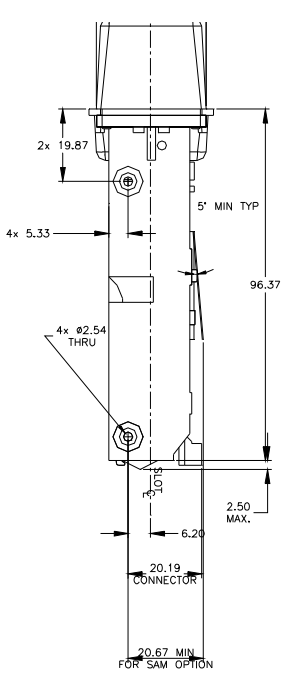

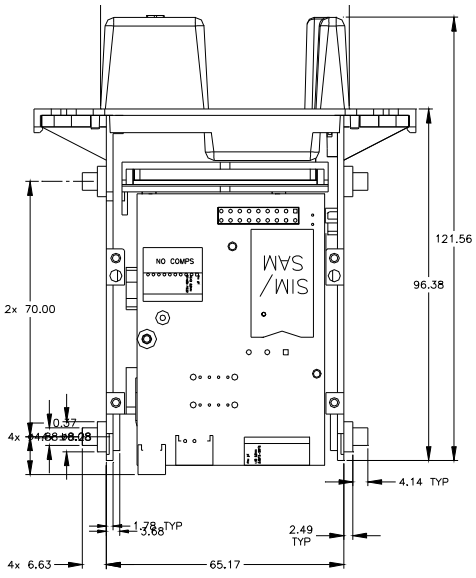

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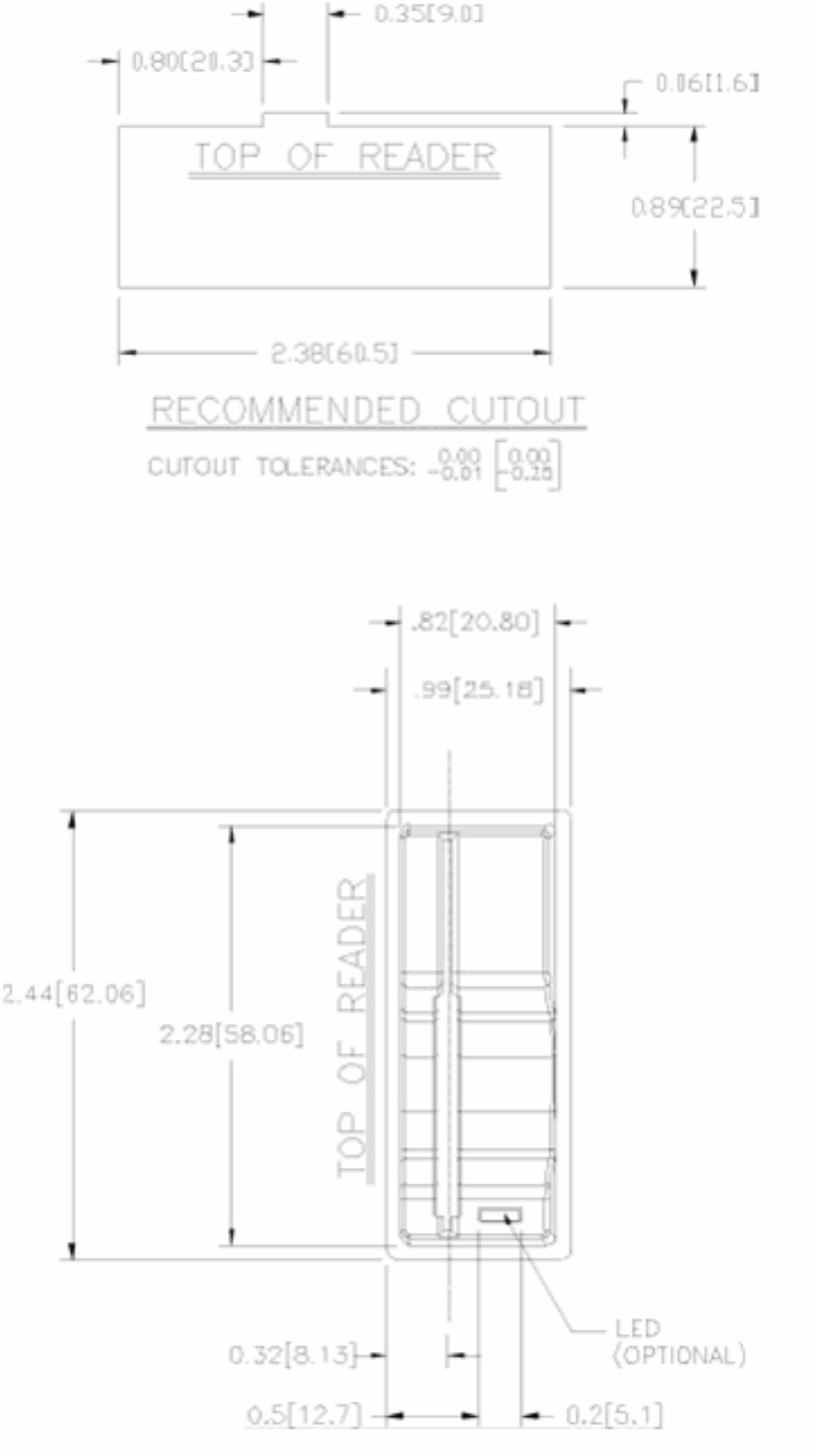
Compact Spectrum III with Bezel Drawing:



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11. APPENDIX A: SPECIAL INSTALLATION INSTRUCTIONS

For standard installation instructions refer to QUICK START on page 13.

11.1. Installing Unsigned Driver Over Signed Drivers

This procedure should only be done if requested to do so by ID TECH personal. One has to be careful when installing a driver that has not been signed over a driver that has been signed, the Windows operating system prefers the signed driver and if you are not paying attention Windows will say I found a better driver than the one you specified and go ahead and install that. Try these instructions.

Unzip the driver below in an appropriate place and remember where that directory is. Then go to settings/control panel/system/hardware/device manager

- Select smart card readers then
- Right click on the name of the driver installation file (.inf) ...
- Select properties/driver/update driver/next
- Select display list of known drivers .../next
- Select have disk/browse/browse select the location when the driver was unzipped
- Select OK/next/next and yes to the prompt that digital signature not found
- Then finish/close.

11.2. Configuring to Allow Installation of Unsigned Drivers

The default configuration of XP can be changed to disallow the installation of an unsigned driver. If your PC has been so configured it will be necessary to control panel/system/hardware/driver signing and confirm the setting is not “block”, “warn” is the default setting.

11.3. Configuring to Display System Files

Note because drivers are system files (*.sys) they are not be visible by default with windows explorer To display system files in a Windows 2000 system go to explorer/tools/folder options/view and uncheck boxes hide file extensions of known types and uncheck hide protected operating system files.

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11.4. Configuring the Smart Card Service

If the PC/CS demo application cannot connect to SPT3u (or SPT3s in PC/SC mode) because it gets the error “Smart card resource manager not running,” then go to ‘Start’ [then ‘Settings’] then ‘Control Panel’ [then ‘Performance and Maintenance] then ‘Administrative Tools’ then ‘Services’ then scroll down to ‘Smart Card’ service and check to see if the status on the Smart Card service is started and the startup type set to automatic. This service should be set to ‘Automatic’ and ‘Started’. If not then to change these settings right click on the line that says Smart Card then under the general tab go down to start-up type and change the setting to automatic. Then under service status select Start. Verify that the demo application can connect to the reader.

11.5. Reconnecting a Disconnected Reader

If an RS232 PC/SC reader is disconnected or powered down while operating, the demo application will no longer be able to connect to the reader. To correct this situation, reboot the P/C or in the control panel disable the reader and re-enable the reader. The demo application should now be able to connect to the reader.

If any PC/SC reader is disconnected and reconnected the file handle the application communicated with the driver becomes invalid, it is necessary to disconnect the application from and reconnect to the driver. This usually means closing and restarting the application. The SPT3CppPcscDemo show how to do this automatically.

If the SPT3c reader is disconnected and reconnected close and reopen the application to continue to communicate with the reader.

11.6. Configuring PC to Support Serial Plug and Play

If the PC boots With a SPT3s configured for Plug and Play without displaying a message that new hardware has been installed and you are installing a RS232 reader, your PC is probably not configured for Plug and Play on the serial connections. If the supplied reader has an LED, the LED control is in the default setting (under reader control), and that LED remains amber throughout the boot process this is the case. Refer to the PC manufacturers instructions on configuring the BIOS for PnP (Plug and Play). To enter the BIOS early during the boot process enter the proper key. The PC will normally display the proper key to press to enter the BIOS). This process varies depending on the BIOS installed in the PC so full instructions would require different instructions for each type of PC.

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12. APPENDIX B: ID TECH PC/SC IDTLIB.DLL GUIDE

Purpose of this library is to simplify access to reader when using vendor specific functions like magnetic stripe reading and latch control. This library is not required: all functions can be done by the application without requiring this DLL. This DLL is provided to make the programming of an application to utilize the reader's functions simpler.

The error return codes are either SCARD_S_SUCCESS for success, "–1", if the function failed entirely or the standard smart card error codes see – SCARD Routine Return Values page 92.

Function prototypes for the callable functions in the IDTLIB.DLL for handling vendor specific IOCTL calls to the ID TECH hybrid reader in a Windows PC/SC environment.

Note: hCard is the card handle returned by Windows from SCardConnect().

IDTLIB_API LONG IdtGetVersion (
OUT BYTE *versionBuffer, // pointer to buffer to hold the version string.
// buffer must be at least 7 bytes long.
IN OUT DWORD *versionBufferLength);

DWORD versionBufferLength is an unsigned long integer (32 bits) that holds the length of the buffer in bytes to hold the version string when called and on return to hold the actual size in bytes of the version string. This function returns version of IDTDLL.DLL.

IDTLIB_API LONG IdtReadMagstripe (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT BYTE *outputBuffer,
IN OUT DWORD *outputBufferLength,
IN BOOLEAN TurnCardOff);

IDTLIB_API LONG IdtSendCommand (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE *commandBuffer, // pointer to buffer with command to send to reader.
IN DWORD commandLength,
OUT BYTE *responseBuffer,
IN OUT DWORD *responseBufferLength);
DWORD commandLength is an unsigned long integer (32 bits) that holds the length of the command in the commandBuffer
BYTE *responseBuffer is a pointer to a byte buffer into which the response from the reader will be placed.
DWORD responseLength is an unsigned long integer (32 bits) that holds the length of the response in bytes in the responseBuffer

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IDTLIB_API LONG IdtLatch (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtUnlatch (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtCardOff (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

IDTLIB_API LONG IdtSetMagstripeTimeout (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN UCHAR timeout);
UCHAR timeout is an unsigned character holding the new timeout value in seconds.
UCHAR timeout is an unsigned character (8 bits) value of the timeout value in seconds.

IDTLIB_API LONG IdtGetMagstripeTimeout (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *timeout); // returns timeout value in seconds.

IDTLIB_API LONG IdtGetDriverVersion (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *drvrVersion);

IDTLIB_API LONG IdtGetFirmwareVersion (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *fwVersion); // pointer to buffer to receive flashware version.

LONG IDTLIB_API IdtGetReaderState (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *readerState);
// Get the current (cached) state of the reader
// readerState is defined as follows:
// bit 0: power, 0 => not ready, 1 => ready
// bit 1: card, 0 => card not seated, 1 => card seated
// bit 2: latch, 0 => released, 1 => closed
// bit 3: card, 0 => card not present, 1 => card present

This version only returns the cached version of reader state in the driver. It avoids sending a smart card command to the reader and should be used when the user is only interested in the info relating to whether the card is seated, present, or removed. Since reader state is updated when card notification is received, it may not reflect the TRUE current reader state as far as other state information such as latch state is concern. To obtain the TRUE reader state of the reader, use IdtGetReaderStateDirect.

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LONG IDTLIB_API IdtGetReaderStateDirect (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
OUT UCHAR *readerState);
// Get the current state of the reader
// readerState is defined as follows:
// bit 0: power, 0 => not ready, 1 => ready
// bit 1: card, 0 => card not seated, 1 => card seated
// bit 2: latch, 0 => released, 1 => closed
// bit 3: card, 0 => card not present, 1 => card present

Note this version of API will send a smart card command to the reader. If you are only interested in the current card state, i.e. whether the card is seated, present, or removed, use IdtGetReaderState, which returns the cached state without sending a smart card command to the reader.

LONG IDTLIB_API IdtSetLEDColor (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE LEDColor); // a color reader will set to.

This API is used to set the LED color, provided the reader is set into the host controlled mode.

The LED colors are defined as (note that they are in ASCII):

#define	LED_OFF	'0'
#define	LED_GREEN	'1'
#define	LED_RED	'2'
#define	LED_AMBER	'3'
#define	REDAMB_FLASH	'4'
#define	GREEN_FLASH	'5'
#define	RED_FLASH	'6'
#define	AMBER_FLASH	'7'

LONG IDTLIB_API IdtSetMSRReadMode (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE readMode); // is the MSR mode reader will set to.

This API is used to set the MSR read mode and read modes are defined as (note that they are in ASCII):

#define	MSR_MODE_DISABLE	'0'	
#define	MSR_MODE_AUTO_TX	'1'	// auto-transmit mode
#define	MSR_MODE_BUFFER	'2'	// buffered mode (forced for PC/SC)

LONG IDTLIB_API IdtResetMSRBuffer (
IN ULONG hCard); // unsigned long integer (32 bits) card handle

This API is used to reset the MSR buffer (clear the buffer) and put the reader into disarmed state.

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LONG IDTLIB_API IdtStartMagstripe (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN DWORD outputBufferLength,
IN BOOLEAN TurnCardOff);

This API is used to initiate the reading of MSR data. The user is expected to follow up this call by polling the reader for MSR data using IdtPollMagstripe (). This is only for use in non-buffered mode.

LONG IDTLIB_API IdtPollMagstripe (
IN ULONG hCard, // unsigned long integer (32 bits) card handle
IN BYTE TrackSelect, // byte to select tracks of magnetic stripe
OUT BYTE *outputBuffer, // pointer to a buffer containing the magnetic data
OUT DWORD *outputBufferLength);
DWORD outputBufferLength is a pointer to an unsigned long integer that holds the length of magnetic data.

This API is used to poll the reader after the user has issued the IdtStartMagstripe () call. If the MSR data is available, it will be returned according the tracks selected. This is only for use in non-buffered mode.

Return code:
—SCARD_S_SUCCESS: MSR data available.
—SCARD_E_NOT_READY: MSR data not available yet.
—SCARD_E_TIMEOUT: Attempt to read has timed out.

Track selections are defined as follows (note that they are in ASCII):

```
#define     MSR_RD_ANY_TRK      '0'
#define     MSR_RD_TRK_1        '1'
#define     MSR_RD_TRK_2        '2'
#define     MSR_RD_TRK_12       '3'
#define     MSR_RD_TRK_3        '4'
#define     MSR_RD_TRK_13       '5'
#define     MSR_RD_TRK_23       '6'
#define     MSR_RD_ALL_TRK      '7'
```

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Write Your Own Functions

If you wish to write your own functions and eliminate the use of the DLL all these commands use the ScardControl () to communicate with the driver.
http://msdn.microsoft.com/library/default.asp?url=/library/en-us/security/Security/scardcontrol.asp

```
LONG SCardControl (
    SCARDHANDLE hCard,
    DWORD dwControlCode,
    LPCVOID lpInBuffer,
    DWORD nInBufferSize,
    LPVOID lpOutBuffer,
    DWORD nOutBufferSize,
    LPDWORD lpBytesReturned);
```

Parameters

hCard	[in] Reference value returned from SCardConnect.
dwControlCode	[in] Control code for the operation. This value identifies the specific operation to be performed.
lpInBuffer	[in] Pointer to a buffer that contains the data required to perform the operation. This parameter can be NULL if the *dwControlCode* parameter specifies an operation that does not require input data.
nInBufferSize	[in] Size, in bytes, of the buffer pointed to by *lpInBuffer*.
lpOutBuffer	[out] Pointer to a buffer that receives the operation's output data. This parameter can be NULL if the *dwControlCode* parameter specifies an operation that does not produce output data.
nOutBufferSize	[in] Size, in bytes, of the buffer pointed to by *lpOutBuffer*.
lpBytesReturned	[out] Pointer to a DWORD that receives the size, in bytes, of the data stored into the buffer pointed to by *lpOutBuffer*.

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Return Values

This function returns different values depending on whether it succeeds or fails. Success SCARD_S_SUCCESS. Failure An error code, see Table 13 – SCARD Routine Return Values page 92.

Example:

SMARTCARD_MACRO	SCARD_CTL_CODE
SMARTCARD_VS_GENERIC_COMMAND	2100
SMARTCARD_VS_LOCK_LATCH	2101
SMARTCARD_VS_UNLOCK_LATCH	2102
SMARTCARD_VS_GET_MAGSTRIPE	2103
SMARTCARD_VS_SET_MAGSTRIPE_TIMEOUT_COMMAND	2104
SMARTCARD_VS_GET_MAGSTRIPE_TIMEOUT_COMMAND	2105
SMARTCARD_VS_GET_DRIVER_VERSION_COMMAND	2106
SMARTCARD_VS_GET_FIRMWARE_VERSION_COMMAND	2107
SMARTCARD_VS_GET_READER_STATE_COMMAND	2108
SMARTCARD_VS_START_MAGSTRIPE	2109
SMARTCARD_VS_POLL_MAGSTRIPE	2110
SMARTCARD_VS_SET_MSR_READ_MODE	2111
SMARTCARD_VS_GET_MSR_READ_MODE	2112
SMARTCARD_VS_MSR_RESET	2113
SMARTCARD_VS_MSR_ARM_TO_READ	2114
SMARTCARD_VS_MSR_READ_DATA	2115
SMARTCARD_VS_HOST_LED_CTRL	2116
SMARTCARD_VS_READER_RESET	2117

```
#define SMARTCARD_VS_GET_MAGSTRIPE      SCARD_CTL_CODE (2103)

    // wait for the card to be removed and read the magnetic stripe


LONG    IDTLIB_API  IdtReadMagstripe(
    IN ULONG hCard,
    OUT BYTE *outputBuffer,
    IN OUT DWORD *outputBufferLength,
    IN BOOLEAN TurnCardOff) {
    DWORD bytesBack;
    LONG ret;

    If (TurnCardOff)
            IdtCardOff (hCard);
    ret = SCardControl (hCard, SMARTCARD_VS_GET_MAGSTRIPE, NULL, 0,
            outputBuffer, *outputBufferLength, &bytesBack);
    *outputBufferLength = bytesBack;
    return ret;
}
```

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Table 13 – SCARD Routine Return Values

Value	Description
ERROR_BROKEN_PIPE	The client attempted a smart card operation in a remote session, such as a client session running on a terminal server, and the operating system in use does not support smart card redirection.
SCARD_E_BAD_SEEK	An error occurred in setting the smart card file object pointer.
SCARD_E_CANCELLED	The action was canceled by a SCardCancel request.
SCARD_E_CANT_DISPOSE	The system could not dispose of the media in the requested manner.
SCARD_E_CARD_UNSUPPORTED	The smart card does not meet minimal requirements for support.
SCARD_E_CERTIFICATE _UNAVAILABLE	The requested certificate could not be obtained.
SCARD_E_COMM_DATA_LOST	A communications error with the smart card has been detected.
SCARD_E_DIR_NOT_FOUND	The specified directory does not exist in the smart card.
SCARD_E_DUPLICATE_READER	The reader driver did not produce a unique reader name.
SCARD_E_FILE_NOT_FOUND	The specified file does not exist in the smart card.
SCARD_E_ICC_CREATEORDER	The requested order of object creation is not supported.
SCARD_E_ICC_INSTALLATION	No primary provider can be found for the smart card.
SCARD_E_INSUFFICIENT_BUFFER	The data buffer for returned data is too small for the returned data.
SCARD_E_INVALID_ATR	An ATR string obtained from the registry is not a valid ATR string.
SCARD_E_INVALID_CHV	The supplied PIN is incorrect.
SCARD_E_INVALID_HANDLE	The supplied handle was invalid.
SCARD_E_INVALID_PARAMETER	One or more of the supplied parameters could not be properly interpreted.

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SCARD_E_INVALID_TARGET	Registry startup information is missing or invalid.
SCARD_E_INVALID_VALUE	One or more of the supplied parameter values could not be properly interpreted.
SCARD_E_NO_ACCESS	Access is denied to the file.
SCARD_E_NO_DIR	The supplied path does not represent a smart card directory.
SCARD_E_NO_FILE	The supplied path does not represent a smart card file.
SCARD_E_NO_MEMORY	Not enough memory available to complete this command.
SCARD_E_NO_READERS_AVAILABLE	No smart card reader is available.
SCARD_E_NO_SERVICE	The smart card resource manager is not running.
SCARD_E_NO_SMARTCARD	The operation requires a smart card, but no smart card is currently in the device.
SCARD_E_NO_SUCH_CERTIFICATE	The requested certificate does not exist.
SCARD_E_NOT_READY	The reader or card is not ready to accept commands.
SCARD_E_NOT_TRANSACTED	An attempt was made to end a nonexistent transaction.
SCARD_E_PCI_TOO_SMALL	The PCI receive buffer was too small.
SCARD_E_PROTO_MISMATCH	The requested protocols are incompatible with the protocol currently in use with the card.
SCARD_E_READER_UNAVAILABLE	Specified reader is not currently available for use.
SCARD_E_READER_UNSUPPORTED	The reader driver does not meet minimal requirements for support.
SCARD_E_SERVICE_STOPPED	The smart card resource manager has shut down.
SCARD_E_SHARING_VIOLATION	The smart card cannot be accessed because of other outstanding connections.
SCARD_E_SYSTEM_CANCELLED	The action was canceled by the system, presumably to log off or shut down.
SCARD_E_TIMEOUT	The user-specified time-out value has expired.
SCARD_E_UNEXPECTED	An unexpected card error has occurred.
SCARD_E_UNKNOWN_CARD	The specified smart card name is not recognized.

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SCARD_E_UNKNOWN_READER	The specified reader name is not recognized.
SCARD_E_UNKNOWN_RES_MNG	An unrecognized error code was returned from a layered component.
SCARD_E_UNSUPPORTED_FEATURE	This smart card does not support the requested feature.
SCARD_E_WRITE_TOO_MANY	An attempt was made to write more data than would fit in the target object.
SCARD_F_COMM_ERROR	An internal communications error has been detected.
SCARD_F_INTERNAL_ERROR	An internal consistency check failed.
SCARD_F_UNKNOWN_ERROR	An internal error has been detected, but the source is unknown.
SCARD_F_WAITED_TOO_LONG	An internal consistency timer has expired.
SCARD_P_SHUTDOWN	The operation has been aborted to allow the server application to exit.
SCARD_S_SUCCESS	No error was encountered.
SCARD_W_CANCELLED_BY_USER	The action was canceled by the user.
SCARD_W_CHV_BLOCKED	Card cannot be accessed because the maximum number of PIN entry attempts has been reached.
SCARD_W_EOF	The end of the smart card file has been reached.
SCARD_W_REMOVED_CARD	Smart card has been removed, so further communication is not possible.
SCARD_W_RESET_CARD	Smart card has been reset, so any shared state information is invalid.
SCARD_W_SECURITY_VIOLATION	Access was denied because of a security violation.
SCARD_W_UNPOWERED_CARD	Power has been removed from the smart card, so that further communication is not possible.
SCARD_W_UNRESPONSIVE_CARD	Smart card is not responding to a reset.
SCARD_W_UNSUPPORTED_CARD	Reader cannot communicate with the card, due to ATR string configuration conflicts.
SCARD_W_WRONG_CHV	Card cannot be accessed because the wrong PIN was presented.

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13. APPENDIX C: DOWNLOADING

See \manuals\Down Load Manual Spectrum 3_v1_01

Downloading is used to update the reader firmware. If it is necessary to update the Spectrum III firmware please see the Spectrum III Down Load Manual. Downloading is done from a Windows PC. The command to enter the downloader is to send an enveloped ‘z’ to the reader. The reader will acknowledge this command and then enter the downloader.

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14. APPENDIX C: Complete List of Response Codes

[2A01] configuration update failed
[2A02] configuration update failed
[2A03] unable to write byte to EEPROM configuration
[2A04] configuration update failed
[2A05] configuration update failed
[2A06] no icc voltage not defined on connector
[2A07] length != 1 or 2 on SAM options setting
[2A09] command aborted by the icc
[2A0A] sle4406 parameters error
[2A0B] sle4406 parameters error
[2B00] sle4404 invalid address must be even 16 bit boundary
[2C02] no microprocessor icc seated
[2C03] no memory card seated
[2C04] no T=1 raw card seated
[2C06] no card seated to request ATR
[2C08] T=1 card unseated
[2C09] T=0 card unseated
[2D00] memory card type not supported
[2D01] Card Not Supported,
[2D03] Card Not Supported, wants CRC
[2F01] Fault Alarm, ICC powered off
[6686] 4404 no more counter to decrease
[6686] gpm271 no more counter to decrease
[6686] gpm276 no more counter to decrease
[6686] not enough tokens
[6687] sle4428 report no retries remain
[6687] sle4442 report no retries remain
[6688] 4406 invalid secret key presented
[6688] 4428 invalid PSC presented
[6688] sle4442 invalid PSC presented
[6701] failed to properly reset configuration
[6704] gpm271 read value different from expected
[6705] gpm276 byte(s) not successfully erased
[6706] 4406 invalid length
[6707] sle4404 value written doesn't match
[6708] sle4404 value written to fuse doesn't match expected
[6709] sle4406 value written doesn't match
[6900] latch function subtype must be 0 or 1
[6903] reader configured without icc support
[6904] reader configured without icc support
[6905] rdr not configured with SAM support or SAM conn > 5
[6906] reader configured without icc support
[6907] reader configured without icc support
[6908] 'R' cmd subtype invalid

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[6909] invalid baud rate value
[690A] Set C4 cmd legal values only 0-1
[690B] Set C8 cmd legal values only 0-1
[690C] set cmd subtype invalid
[690D] cmd not supported on rdr without icc support
[690E] invalid cmd response
[690F] invalid baud rate value
[6910] invalid serial number length
[6911] 'Q' cmd length must be 1
[6912] 'P' cmd length must be 1
[6913] 2nd byte of LED cmd must be 30-37
[6914] invalid value of the memory card type
[6916] 'P' cmd must be 0x30 or 0x32
[6918] gpm276 cannot erase 0 bytes
[6919] gpm271 count of bytes to erase is zero
[691B] sle4404 cannot erase 0 bytes or odd # of bytes
[691C] sle4404 password must be even # of bytes > 0
[691D] download code missing or corrupted
[691E] MSR read method must be 1, 2, 3 or 4
[691F] host LED control not enabled
[6920] Reader not configured for buffered mode
[6921] reader not configured for buffered mode
[6922] Reader not configured for magstripe read
[6D01] INS not supported on i2c cards
[6D02] INS not supported on sle4428 cards
[6D03] INS not supported on sle4442 cards
[6D04] INS not supported on gpm271 cards
[6D05] INS not supported on gpm276 cards
[6D06] INS not supported on sle4404 cards
[6D07] INS not supported on sle4406 cards
[6E00] memory card class must be 'DA'
[8001] sle4428 count bytes to verify must be 2
[8002] i2c no Data or write cnt != byte recvd
[8003] sle4428 count bytes to read required
[8004] sle4428 no Data or write cnt != bytes recvd
[8005] i2c count bytes to read required
[8006] sle4442 count bytes to verify must be 3
[8007] sle4428 no Data or write cnt != bytes recvd
[8008] sle4442 count bytes to read required
[8009] sle4442 count of protection bytes to read must be 4
[800A] sle4442 no Data or write cnt != byte recvd
[800B] sle4442 no Data or write cnt != byte recvd
[800D] gpm271 count bytes to read required
[800E] sle4428 count bytes to read required
[800F] gpm276 count bytes to read required
[8013] sle4406 count bytes to read required

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[8014] sle4404 count bytes to read required
[8015] sle4404 no Data or write cnt != byte recvd
[8016] gpm276 no Data or write cnt != byte recvd
[8017] gpm271 no Data or write cnt != byte recvd
[8018] sle4406 no Data or write cnt != byte recvd
[8019] setting mag prefix D2 cmd invalid length
[801A] setting mag postfix D3 cmd invalid length
[801B] setting baud rate invalid length
[801C] Case 2 incorrect Data length or should be write cmd
[801D] Case 4 incorrect Data length
[8100] icc err time out on power-up req. by Sp2 Driver
[8100] icc error timeout on power-up
[8100] timeout rcving proc byte from T=0 card
[8101] icc timeout error
[8200] invalid TS character received
[8300] T=0 parity on header transmission
[8301] T=0 parity on transmission
[8400] parity err rcving proc byte from T=0 card
[8500] PPS confirmation error
[8501] PPS confirmation error unexpected input
[8600] Unsupported F, D, or combination of F and D
[8700] protocol not supported EMV TD1 out of range
[8800] power not at proper level
[8801] unable to power memory card
[8802] T=1 power not at proper level
[8803] error on power up
[8803] power not at proper level
[8803] power not at proper level
[8804] power not at proper level
[8804] power not at proper level
[8805] power not at proper level
[8805] power not at proper level
[8900] ATR length too long
[8B01] EMV invalid TA1 byte value
[8B02] if EMV TB1 required
[8B03] EMV Unsupported TB1 only 00 allowed
[8B04] EMV Card Error, invalid BWI or CWI
[8B06] EMV TB2 not allowed in ATR
[8B07] EMV TC2 out of range
[8B08] EMV TC2 out of range
[8B09] per EMV96 TA3 must be > 0xF
[8B10] icc error on power-up
[8B11] if EMV96 T=1 then TB3 required
[8B12] Card Error, invalid BWI or CWI
[8B13] Card Error, invalid BWI or CWI
[8B17] EMV TC1/TB3 conflict

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[8B20] EMV TD2 out of range must be T=1
[8C00] TCK error
[9000] assume ISO status is OK
[9000] initialize resp status
[9000] Success
[A301] icc error on power-up current overflow
[A304] connector has no voltage setting
[A305] icc error on power-up invalid (sblk(IFSD) xchg
[A306] icc error on request ATR from CPU icc
[A307] icc error on power-up at current limit
[B0xx] card status reporting
[E300] i2c card ack failure
[E300] io line low--card error after session start
[E301] icc error after session start
[E302] io line low--card error after session start
[E302] T=1 icc error (data too long)
[E303] i2c card ack failure
[E304] T=1 too many retries to get resp
[E305] 3 byte i2c cmd & MS addr ack failure
[E306] 3 byte i2c LS addr ack failure
[E307] 4 byte i2c cmd ack failure
[E308] 4 byte i2c MS addr ack failure
[E309] 4 byte i2c LS addr ack failure
[E30A] i2c failure to reset card
[E310] report timeout error
[E311] icc error unexpected input
[E401] error sending command to T=0 card
[E402] error rcving proc byte from T=0 card
[E403] T=0 error getting 2nd status byte
[E404] T=0 inconsistent proc byte rcvd
[E405] T=0 error processing blk after proc byte
[E406] prob rcving proper # bytes from icc
[FFFE] internal error code
[FFFF] if we haven't had a bad status

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15. INDEX

3

3-byte I²C 8, 47

4

4-byte I²C 8, 47

A

AAMVA 10, 12, 52, 53
adaptor 9
ASCII 10
asynchronous card 8, 10, 67
AT88SC101 ..... 8, 47
ATR 10, 39, 40

B

BAUD 10, 34
bezel 9, 72
BPI 10
bps 8, 10

C

C-APDU 10
CDC 10, 13, 14, 16
CDL 10, 53
CE 2
certification 2, 8
chassis 71, 76
CLA 46, 51
coercivity 10, 72
compatibility 38
compliance 8
configure 8, 9
conformal coating 9
contacts 22, 71, 72
cycles 71

D

DB9 ..... 9, 13, 76
debris 8, 10, 76
demonstration 9, 17, 65
dimensions 72, 73
DMV 52
Download 95
drivers license 10

E

electrical 71
EMV 8, 10, 12, 20, 72
environmental 71

F

f/d 8, 10, 51
Firmware upgrade 28
FTDI 13

G

gate 9, 10, 72

H

Hex 10, 12, 39
host 7, 8, 10, 39, 71, 76
hybrid 10

I

ICC 8, 10, 39
IdtCardOff 87
IdtGetDriverVersion 87
IdtGetFirmwareVersion 87
IdtGetMagstripeTimeout 87
IdtGetVersion 86
IdtLatch 87
IdtReadMagstripe 86
IdtSendCommand 86
IdtSetMagstripeTimeout 87
IdtUnlatch 87
IFD 10
IFS 10, 40
INS 46, 51
installation 17, 84
IPS 10, 72
ISO 10, 53
ISO 7810 12
ISO 7811 ..... 12, 52
ISO 7816 ..... 8, 10, 12
ISO 7816-3 21

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J

jack....14, 76

L

latch....9, 28, 29, 72
LED....9, 10, 22, 23, 28, 30, 36, 72
logo....12
LRC....10, 26, 27

M

mA....71, 77
mechanical....72
memory card....10, 39, 47
microprocessor card....7, 8, 9, 10, 11, 21, 39, 67
mounting....76
MSR....10, 31, 33, 52, 55, 56

N

notification....25, 51

O

Oersted....10, 72
OPOS....10, 12

P

P1....46
page size....47
parity....34
PC/SC....8, 10, 12, 14, 20, 36, 59
PnP....10, 36, 37
power....71, 77
PPS....40, 56
protocol....26

R

R-APDU....11
reliability....71
reset....30, 31
RS232....8, 11

S

SAM....9, 11, 48, 49, 50, 51, 72
SCardConnect....59, 86
SCardDisconnect....60
SCardEstablishContext....59
SCardReleaseContext....60
SCardTransmit....59
serial number....37, 38
SLE4404....8, 47
SLE4406....8, 47
SLE4418....8, 47
SLE4428....8, 47
SLE4432....8, 47
SLE4442....8, 47
smart card....11
Sp2....11, 38
Sp3c....11, 13
Sp3s....13
Sp3u....13
status....8, 28
synchronous....8, 11

T

T=0....7, 8, 9, 22, 39, 42
T=1....7, 8, 22, 39, 42
TLP-224....8, 26, 39
transport code....11

U

USB....11, 13, 71

V

voltage....8, 13, 22, 76

W

WHQL....11

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16. LIMITATIONS

Limitations on the use of PC/SC and SAM

All SAM cards must tolerate the voltage setting of any card accessed in the reader.

Limitations on the use of PC/SC and memory cards

The best way to use memory cards in a PC/SC reader is to leave the card type selected as microprocessor card. The only limitation this places on the host application is that memory card ATR commands are not allowed. Memory card ATR commands are not required because all memory cards are powered on with any command sent to them. Second, most memory cards do not support ATR commands so the reader simulates these commands by reading the first four bytes on the card. The problem is that if the memory card type is selected the reader cannot connect to a microprocessor card. PC/SC driver does not know that the memory type is incorrect and will never allow the PC/SC application to attach to the memory card.

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